



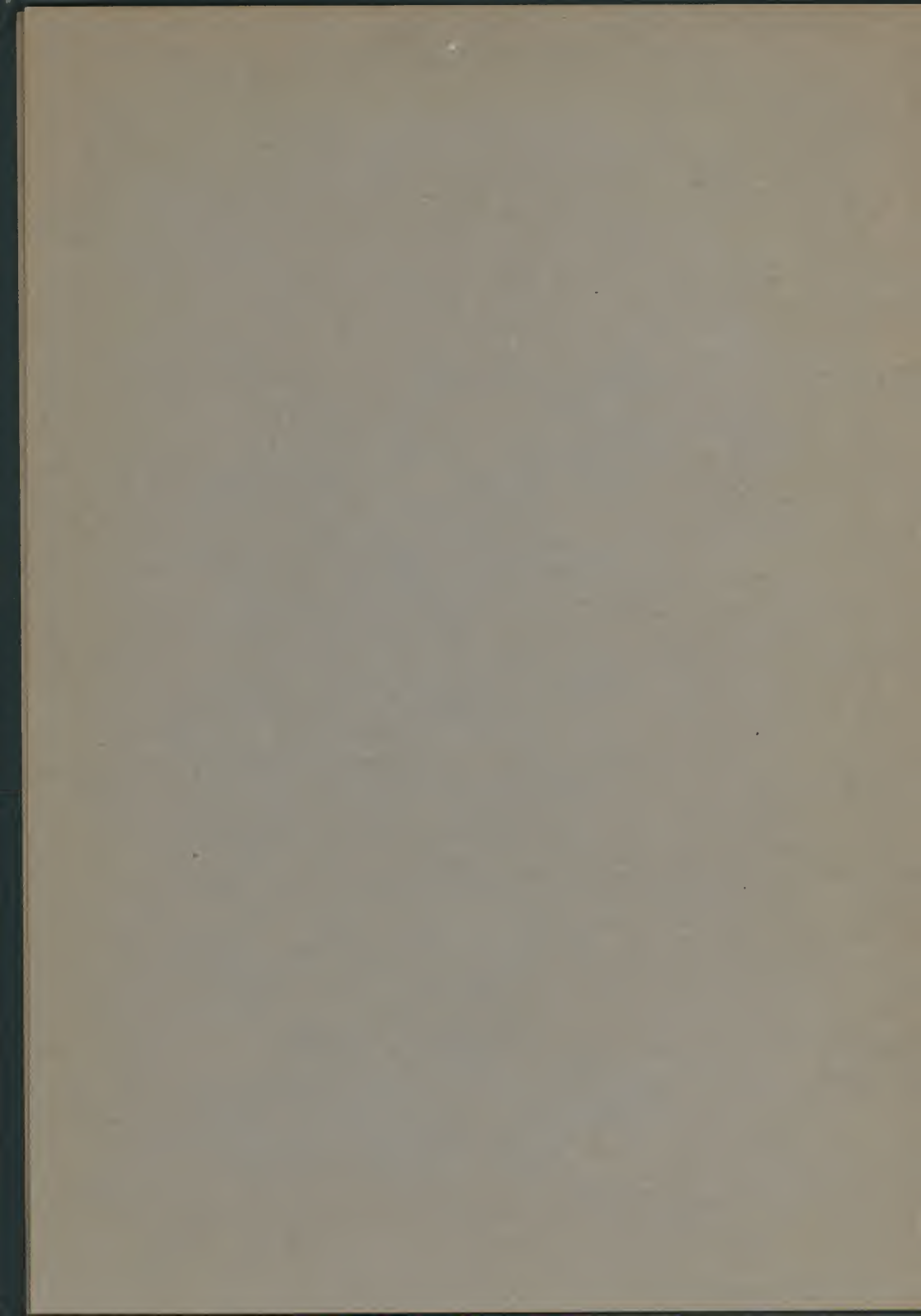
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EMPIRE
BOLTS • NUTS • RIVETS



RUSSELL, BURDSALL & WARD
BOLT AND NUT COMPANY



OLD POWER DAM AT PEMBERWICK

EMPIRE BOLTS · NUTS · RIVETS



ILLUSTRATED
HISTORICALLY
AND
COMMERCIALY
1845-1924

RUSSELL, BURDSALL & WARD
BOLT AND NUT COMPANY
PORT CHESTER, NEW YORK

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Russell, Burdsall & Ward Bolt and Nut Company

RUSSELL, BURDSALL & WARD BOLT AND NUT COMPANY



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EVANS WARD
Vice-President and Gen'l Manager

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Treasurer

WALTER S. COMLY
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HOWARD E. MARSHALL
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ALLAN N. BRADFORD
Manager Rock Falls Plant

F. E. FIKE
Manager Chicago Office



MAIN OFFICE

PORT CHESTER, NEW YORK

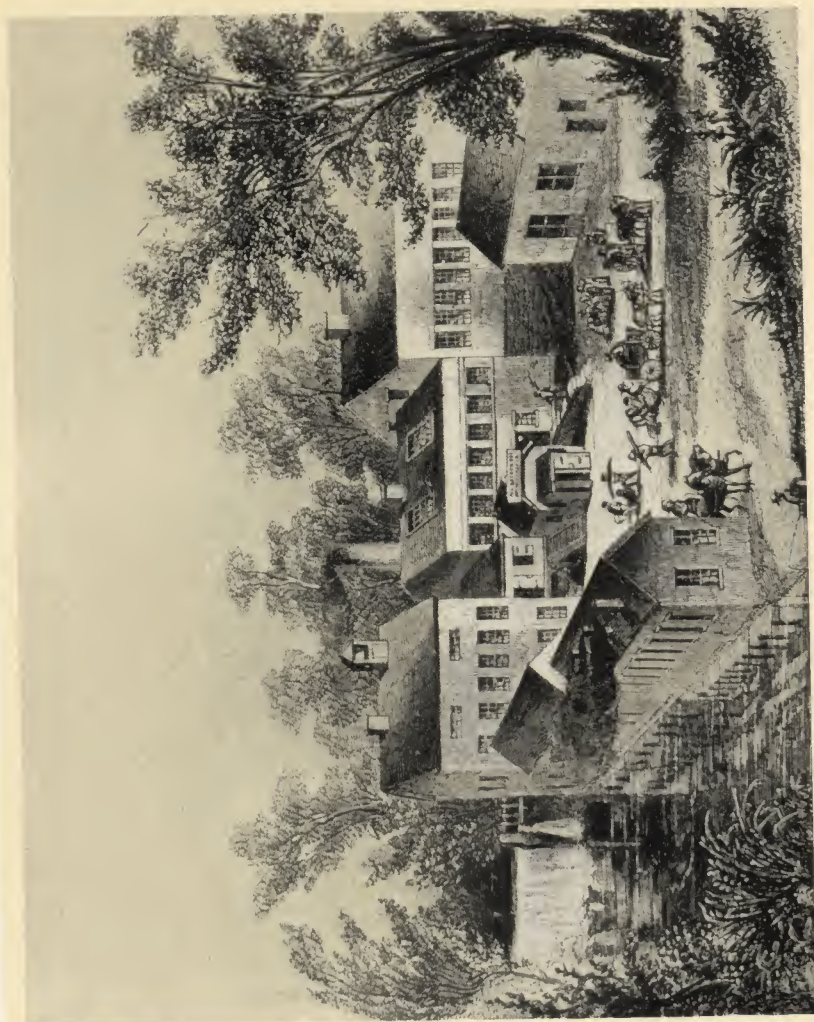
BRANCH OFFICES

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WORKS AT

PEMBERWICK, CONNECTICUT
ROCK FALLS, ILLINOIS
PORT CHESTER, NEW YORK



ORIGINAL PLANT AT PEMBERWICK

BOLTING THE WORLD TOGETHER

By EDWARD MOTT WOOLLEY



WHEN I left the train at Port Chester and walked over to the great plant of the Russell, Burdsall & Ward Bolt and Nut Company, the first outstanding fact was the range of the Company's product—20,000 varieties and sizes of Bolts and Nuts. Thus at the beginning, the province of this corporation took on a glorified meaning—*Service* to a world that must be bolted together.

Sometimes inanimate objects personify themselves in our imagination—it is a picturesque habit of writers and artists to endow them with human qualities. So here at the Russell, Burdsall & Ward plant the product visualizes itself in one's fancy as a curious pigmy genus of animated bolts, nuts and rivets, all much alike in make-up but as

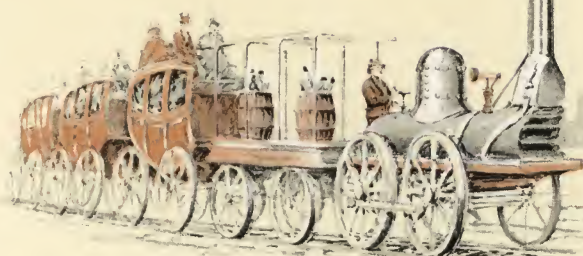


PEMBERWICK PLANT, 1875

different in size as are the creatures of an animal tribe.

Twenty thousand bolt and nut Lilliputians, and each type multiplied by millions! Consider them, if you please, soldiers of commerce—a vast and disciplined army everlastingly recruited here at the plant of the Russell, Burdsall & Ward Company and sent forth to keep the world from falling apart.

But this narrative deals with history and realism, not fancy.





PRESENT PEMBERTON PLANT

*Russell, Burdsall & Ward
Bolt and Nut Company*

The original Bolt Works, still in operation, was founded in 1845 at Pemberwick, Connecticut, three miles from Saw Pits, N. Y.,—now Port Chester, N. Y. In 1882 some of the Russell, Burdsall & Ward people started the Port Chester Bolt and Nut Company—which in 1901 consolidated with the parent concern.

The Port Chester factory now dwarfs the other in size. Here are far-reaching vistas of ponderous machines weirdly human;

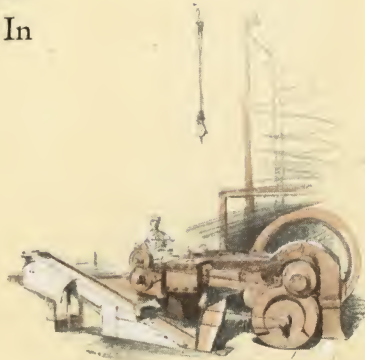




PRESENT PORT CHESTER PLANT

they have eyes and fingers, nerves and brains. Their insatiable jaws consume millions of pounds of steel rods and bars every month. Along every passageway of the many shops these mechanical automations perform for you. They make and handle the biggest or the tiniest bolts and nuts with incomprehensible rapidity and perfection.

In 1907, to give better western service, a plant was purchased at Rock Falls, Ill. In





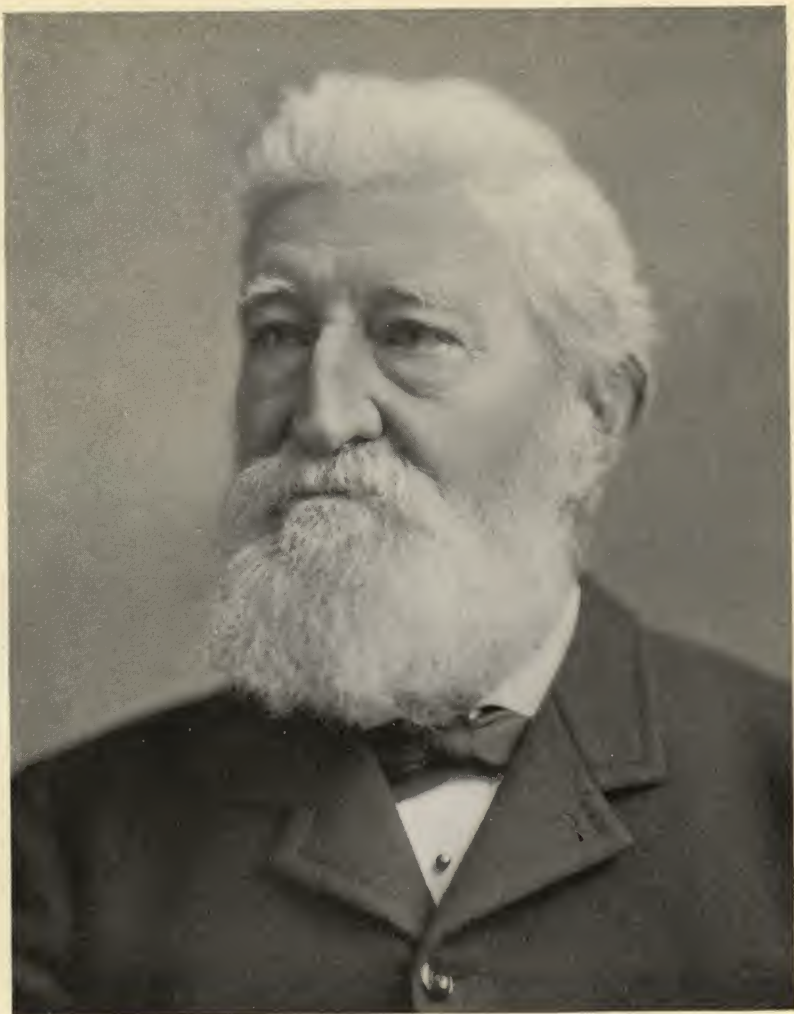
PRESENT ROCK FALLS PLANT

Russell, Burdsall & Ward
Bolt and Nut Company

the three factories are now 1,800 people.

The product of the Company goes to every state in the Union, and to Canada, England, Japan, India, China, Australia, Dutch East Indies, Cuba, Argentine, and many other nations. The largest users are railroads, agricultural implement makers, shipyards, automobile factories, machine shops and engine works; but the Russell, Burdsall & Ward bolts and nuts go into every





WILLIAM E. WARD

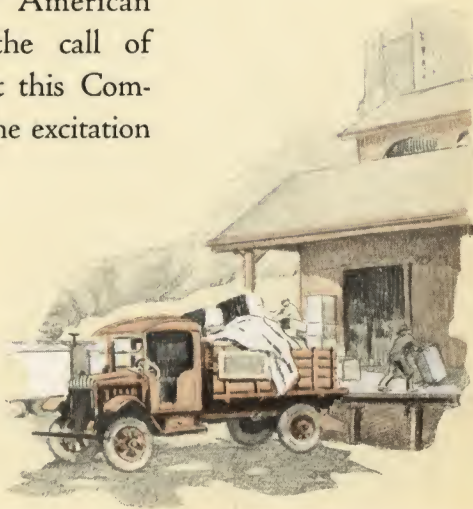
Russell, Burdsall & Ward
Bolt and Nut Company

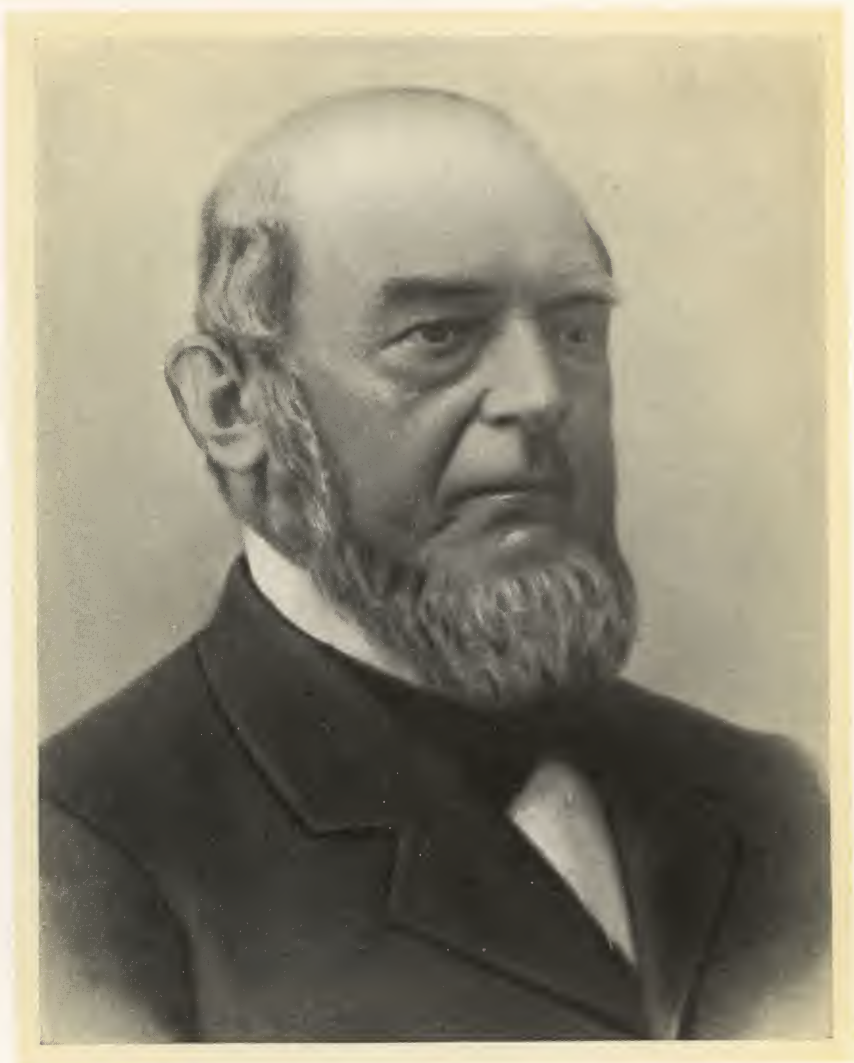
conceivable sort of *bolting service*.

So great a business does not come up without a reason, and the Company accounts for its prestige in two words, the Square Deal—to customers, workmen and mankind.

Prices, too, are considered part of the Square Deal.

During the exaltation of war, every red-blooded American manufacturer felt the call of patriotic prices. But this Company believed that the excitement





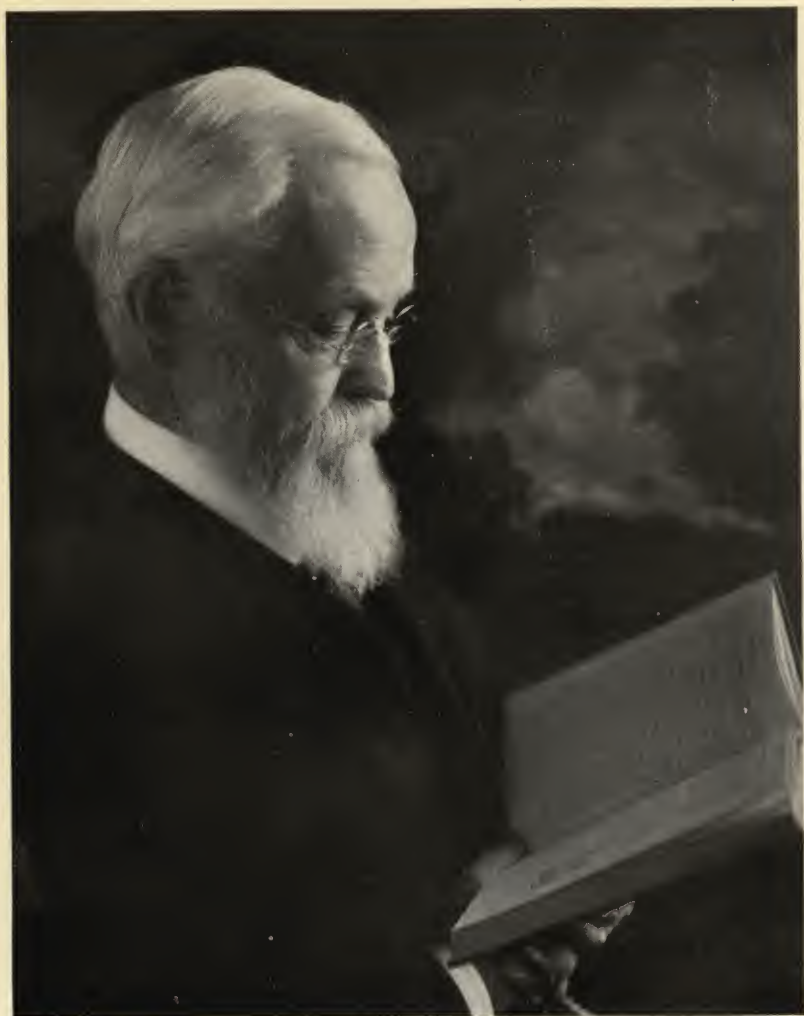
ELLWOOD BURDSALL

Russell, Burdsall & Ward Bolt and Nut Company

of patriotism should not end with Armistice. From August 1, 1919, to the latter part of 1922, the Russell, Burdsall & Ward Bolt and Nut Company never added a cent to its prices, though increasing the pay of its workers twenty-two per cent and meeting soaring costs in all directions.

To maintain these low prices, the Company looked within for mechanical efficiencies. It is their





SAMUEL COMLY

belief that much of the inflation in all lines could have been avoided by constructive work *inside*, instead of passing along the burden to the people.

This price policy brought an avalanche of orders, but the Company served its old customers and turned away a vast volume of business impossible to handle.

At the Bolt Works, principles are not loose generalities. One evidence of this is the Promise



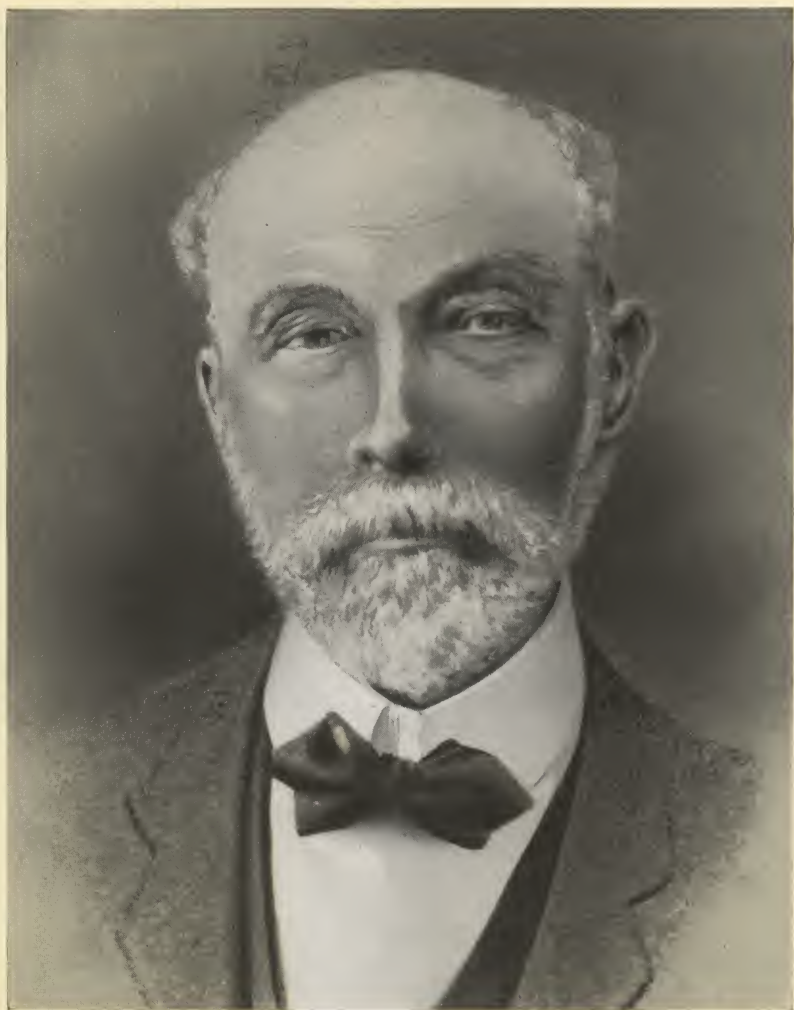


MARY B. ALCOTT

System, through which the Company assures the Square Deal to customers in the filling of orders. An important plank in the factory platform is the infallibility of Promises, so far as infallibility is possible.

In maintaining this principle, every nerve of the organization is alert. The Promise System is one of the most interesting and significant things at Port Chester. It is closely tied up, too, with the placards that hang everywhere



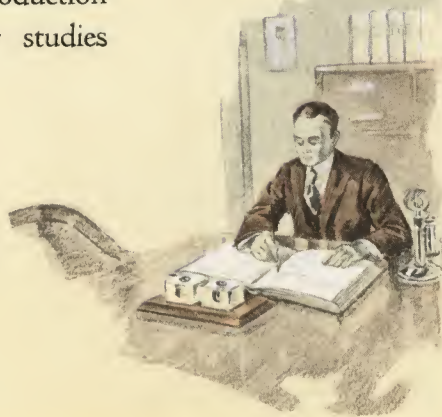


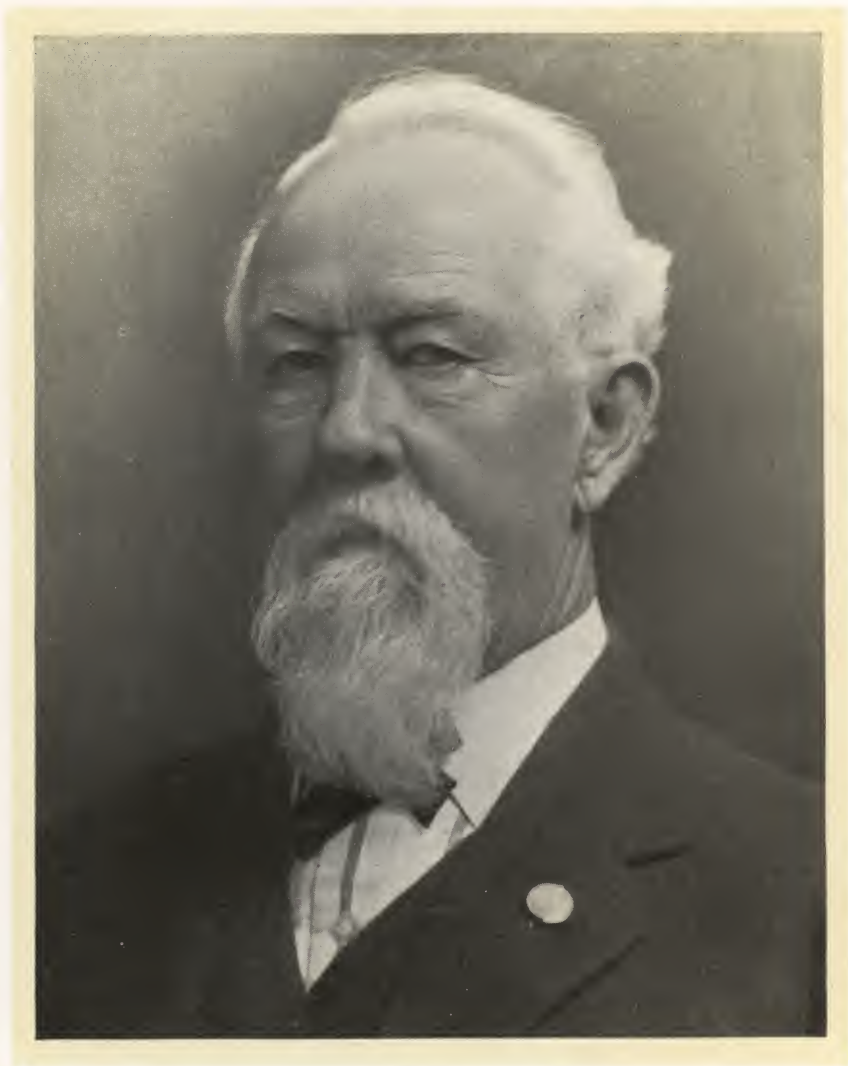
EMIL C. BOERNER

in the works: *Tell the Truth.* Promises must be built on a truthful knowledge of every factory ramification.

The Promise System means, in the first place, expert analysis of all the elements involved in production. Thus in getting material the system plans far ahead, and the factory must know the sources of supply that make good and those that do not.

One man in the Production Department continually studies

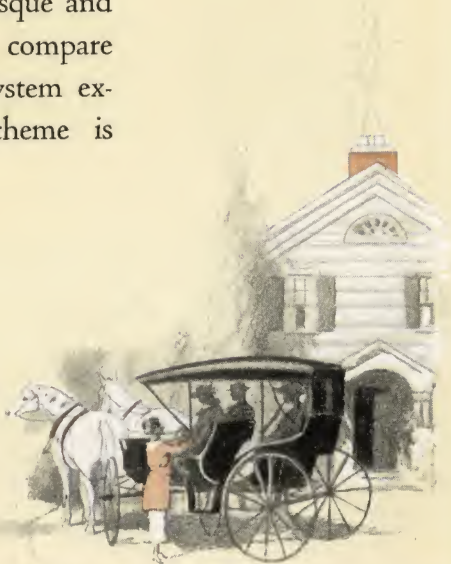


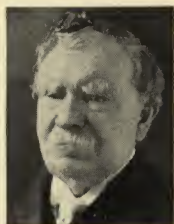


JOSEPH H. MARSHALL

the manner in which the Company's Promises are kept; the big Promise Book is his particular property. And up above is the Sales Office; an executive keeps watchful check on all Promises down below; they call him the Hurry-Up Promise Man.

Here this great Science of Promises is both picturesque and dramatic. You might compare it to a railway signal system except that its color scheme is more elaborate.





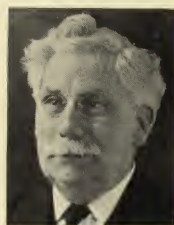
Nicholas Fox
68 years



Ed. Dowd
56 years



Thomas Knott
56 years



Jas. Robinson
56 years



Aaron Adams
55 years



J. Sheeran
53 years



H. Boeger
53 years



Sam. Riker
52 years



Caroline Mead
52 years

EMPLOYEES WHO HAVE WORKED WITH US THIRTY
YEARS OR LONGER

In the Production Department the story of Promises is indeed told in colors. All through the card files, books and forms are signals of red, pink, green, yellow, brown, blue and white, each meaning something pertaining to Promises.

The original brown Promise Sheet is an insurance policy that the whole order will come through on time; it is the parent of quite a family of little red promises; each of which pledges





Jas. Baker
52 years



Tom. Fox
52 years



Harry Platt
52 years



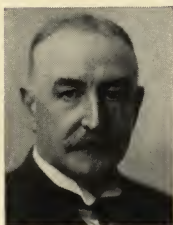
Isaac Haight
51 years



Wm. Wagner
50 years



S. N. LeFevre
48 years



Wm. L. Ward
48 years



Robert McNeil
46 years



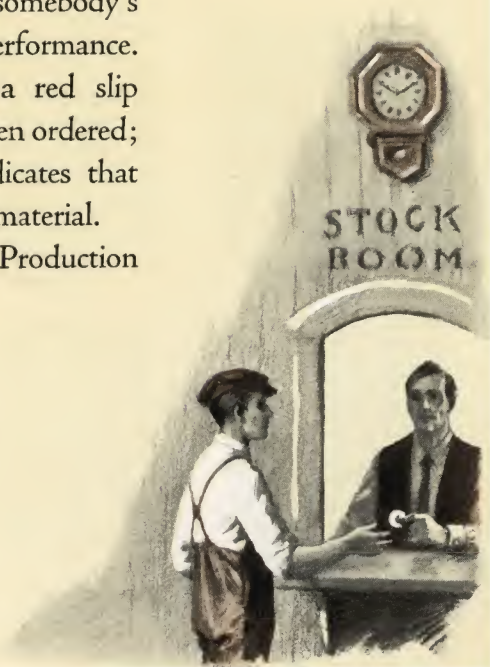
Walter S. Comly
46 years

EMPLOYEES WHO HAVE WORKED WITH US THIRTY
YEARS OR LONGER

some man in the plant for a particular item.

Every order, for instance, requires a blue slip that goes to the tool room—a symbol that implements must be provided; and this slip comes back with a green O.K. in a circle, which is somebody's bond guaranteeing performance. In the filing cases a red slip shows material has been ordered; but a pink signal indicates that a job is held up for material.

There is also a Production





Ellwood Burdsall
45 years



Fred Booth
45 years



Howard E. Marshall
45 years



Florence McNeil
44 years



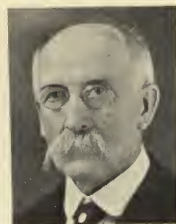
John Kelly
44 years



Wm. Mead
43 years



Geo. Carpenter
43 years



Clifford Reynolds
42 years



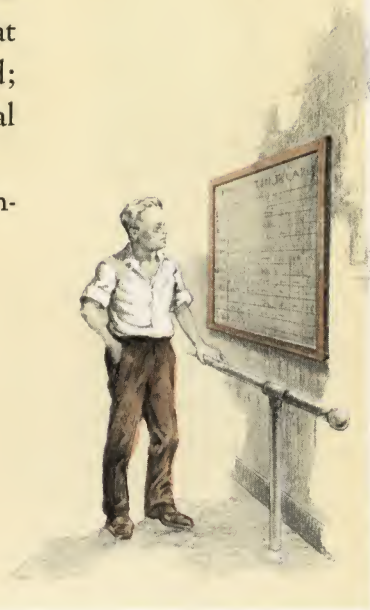
G. I. Lyon
42 years

EMPLOYEES WHO HAVE WORKED WITH US THIRTY
YEARS OR LONGER

Chart in brown, blue, red, yellow and white, which tells instantly what work is scheduled for any machine or group of machines.

On the wall hangs a large Material Board, showing at a glance the status of supplies in progress. A green ticket means that the steel mill has made a promise; a red one shows that some factory has broken its word; a white ticket stands for material on the road.

During November and Decem-





Wm. Weaver
42 years



Geo. Rudd
42 years



H. Mead
41 years



Richard Elmore
41 years



Michael Buckley
40 years



John Marshall
40 years



Augusta L. Boerner
40 years



John H. Mead
39 years



Frank Wolf
39 years

EMPLOYEES WHO HAVE WORKED WITH US THIRTY
YEARS OR LONGER

Russell, Burdsall & Ward
Bolt and Nut Company

ber of 1917 and January of 1918, the United States underwent the worst winter in forty years; and in addition to snow blockades, the war restrictions and shut-downs for lack of coal, tried the organizations of the most highly-developed manufacturers. Yet despite these destructive events, the Russell, Burdsall & Ward Company established an extraordinary record in its Promises for delivery of goods. The following table tells the story:





Carrie Ellis
39 years



Simon Costello
39 years



Frank Robinson
33 years



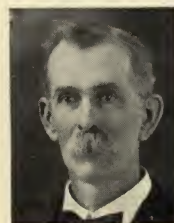
Fortunato Baresi
38 years



Benjamin Pearson
38 years



Frank Behringer
38 years



C. Robbins
37 years



J. McKeever
37 years



Edward Taylor
37 years

EMPLOYEES WHO HAVE WORKED WITH US THIRTY
YEARS OR LONGER

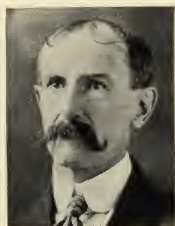
Russell, Burdshall & Ward Bolt and Nut Company

	Promises Made	Promises Broken
1917 November	1,353	2
1917 December	1,281	0
1918 January	1,216	2
1918 February	1,184	1
1918 March	1,312	1
1918 April	1,320	0

For the year 1918 the record of Promises Kept was 99.85%. For the year 1919 the total number of Promises made were 24,729 and of this number 23 were broken—record of Promises Kept was 99.90%.

In those primitive days before this Company was formed,





Edward Bamford
37 years



Henry Goettsche
37 years



Chas. Hackett
36 years



Wm. Bercume
36 years



Jas. Bedford
36 years



Louis Bedford
36 years



Robt. B. M. Cook
36 years



Henry Bender
35 years

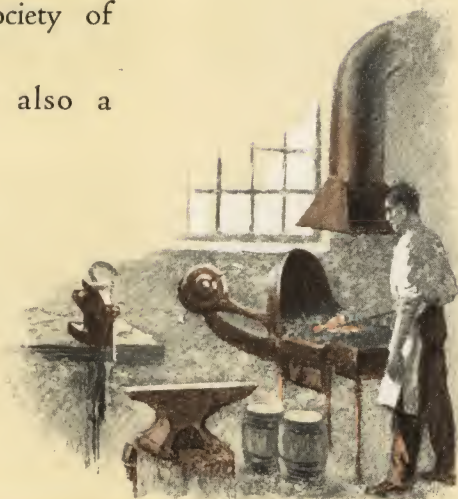


Chas. Olevo
35 years

EMPLOYEES WHO HAVE WORKED WITH US THIRTY
YEARS OR LONGER

practically all bolts and nuts were made by the blacksmith—with hammer, anvil and vise. In 1844 there came to New York William Evans Ward, who in Philadelphia had learned the machinist's trade. He found employment at a Manhattan iron works, and being a Quaker, secured quarters in a boarding-house on Mott Street, conducted by Hannah Ketcham, a member of the Society of Friends.

Ellwood Burdsall, also a





Emma Boerner
35 years



Peter Mead
35 years



Geo. Ellis
35 years



Jas. Morley
35 years



Thos. Pugmire
35 years



J. Yustis
34 years



Salvatore C. Carrieri
34 years



Louis Muller
34 years

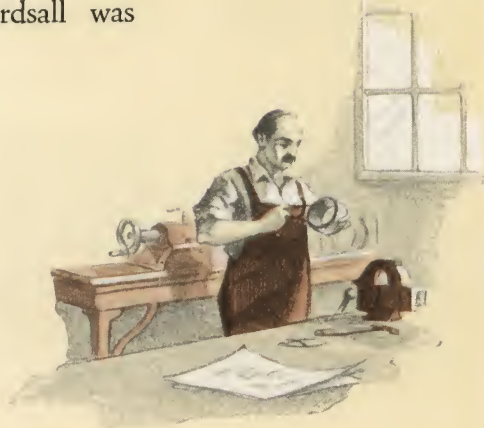


Frank Baronusky
34 years

EMPLOYEES WHO HAVE WORKED WITH US THIRTY
YEARS OR LONGER

Quaker, and a bookkeeper in a New York stove foundry, likewise lived at Mrs. Ketcham's—where lies Chinatown of the Metropolis to-day. Ward and Burdsall became fast friends.

Both were versatile and ambitious. Young Ward was given to invention and believed he could improve very much on a machine for forming the heads of iron rods—in which enterprise his friend Burdsall was most enthusiastic.





Benj. Blakeney
33 years



Daniel Murphy
33 years



John Golden
33 years



Andrew Gunther
32 years



J. Burns
32 years



Daniel O'Toole
32 years



Joseph S. Marshall
32 years



Wm. Barnes
32 years



J. Baresi
32 years

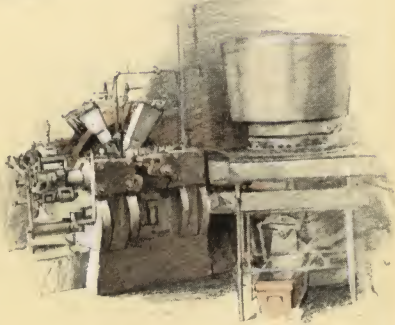
EMPLOYEES WHO HAVE WORKED WITH US THIRTY
YEARS OR LONGER

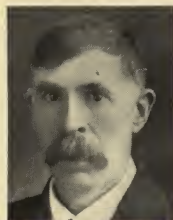
Russell, Burdsall & Ward
Bolt and Nut Company

Burdsall's brother-in-law, Isaac D. Russell, was interested in a small button factory at Pemberwick, and here Burdsall and Ward rented a shop room, with water-power from the Byram River. Young Ward installed a lathe and began experiments.

They had no capital, and Mr. Burdsall's salary of \$600 a year in New York was divided between them, for living expenses and the cost of getting started.

Mr. Ward designed and built





A. Brecken
31 years



W. Steager
31 years



J. Hassan
31 years



J. Brady
31 years



George Theal
30 years



Wm. J. Shiers
30 years



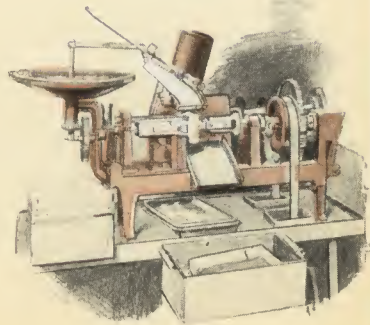
Wm. Steinmetz
30 years

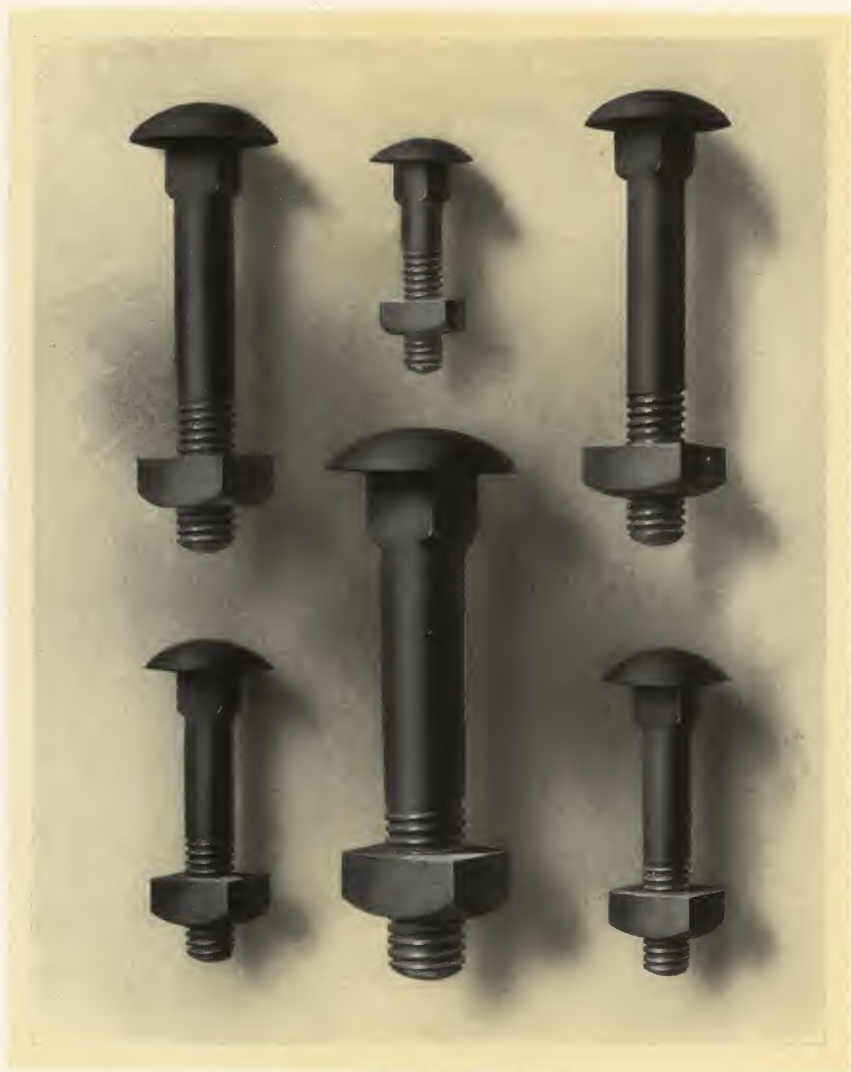
EMPLOYEES WHO HAVE WORKED WITH US THIRTY
YEARS OR LONGER

various machines, and then for a time they manufactured wood screws, calling themselves the Union Screw Company. Another concern, however, obtained a patent on a gimlet-pointed screw and took the wind from their sails.

But they were not men to give up and cry No Opportunity. "If not wood screws, then something else," they agreed.

From a manufacturer in New





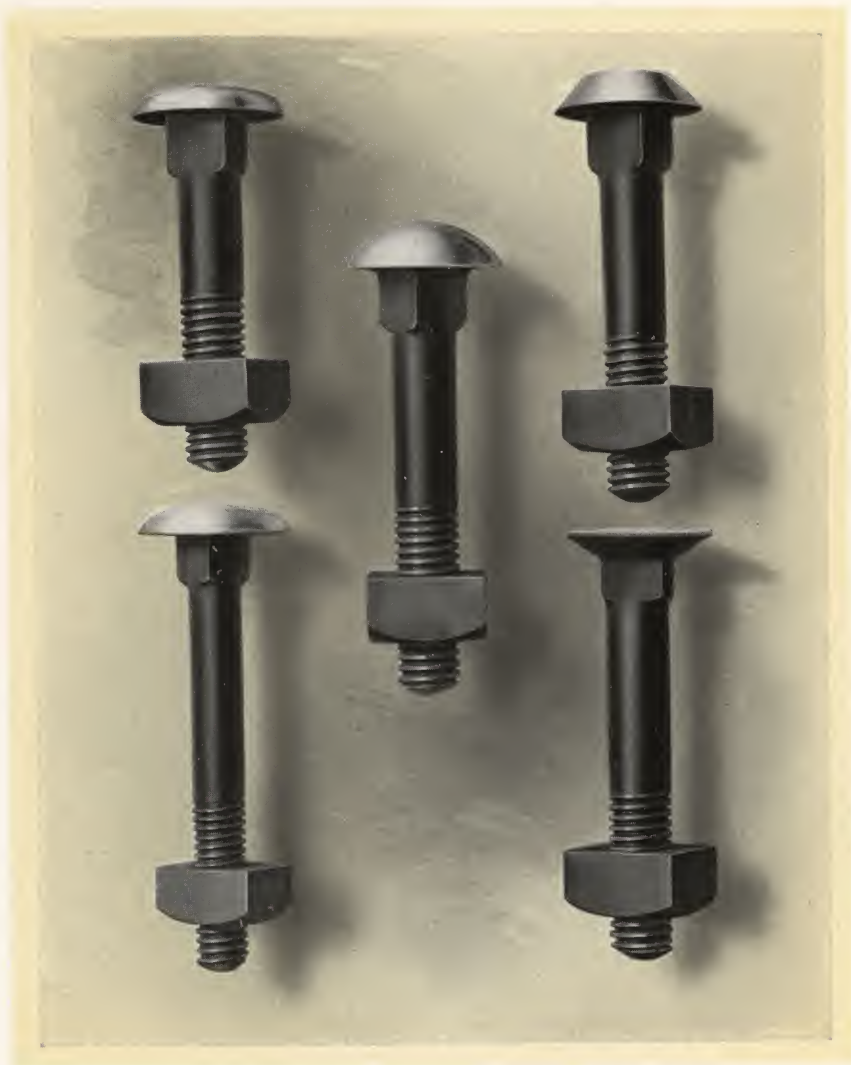
EMPIRE CARRIAGE BOLTS

Russell, Burdsall & Ward Bolt and Nut Company

York Mr. Burdsall learned that screws, if fitted with nuts, could be used in assembling stoves; and the little plant put on the market the first stove bolts and rods.

The business now grew rapidly, Isaac Russell becoming a partner. Burdsall abandoned his pen-and-ink job and devoted himself to the commercial part of the business. He was salesman, correspondent, billing clerk,



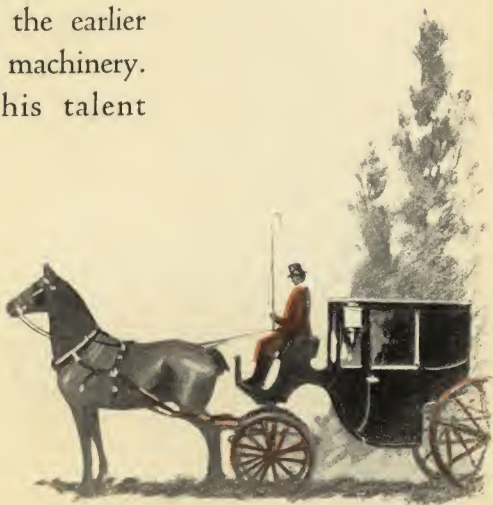


TURNT HEAD EAGLE CARRIAGE BOLTS

treasurer—while partner Ward developed machinery for extending their product to bolts for plows, carriages and machines.

This was a pioneer field. Mr. Ward was a mechanical genius, and some of his machines of early design are still in economical operation. He went on inventing for many years and developed nearly all the earlier bolt and nut-making machinery.

At times, too, his talent

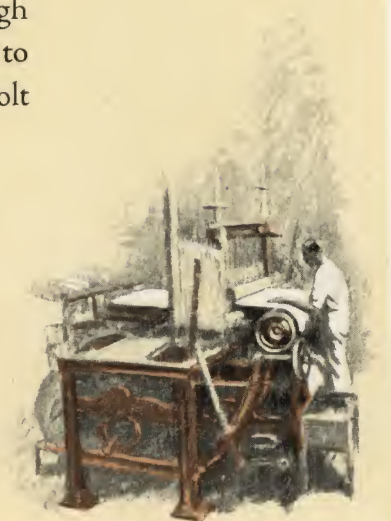


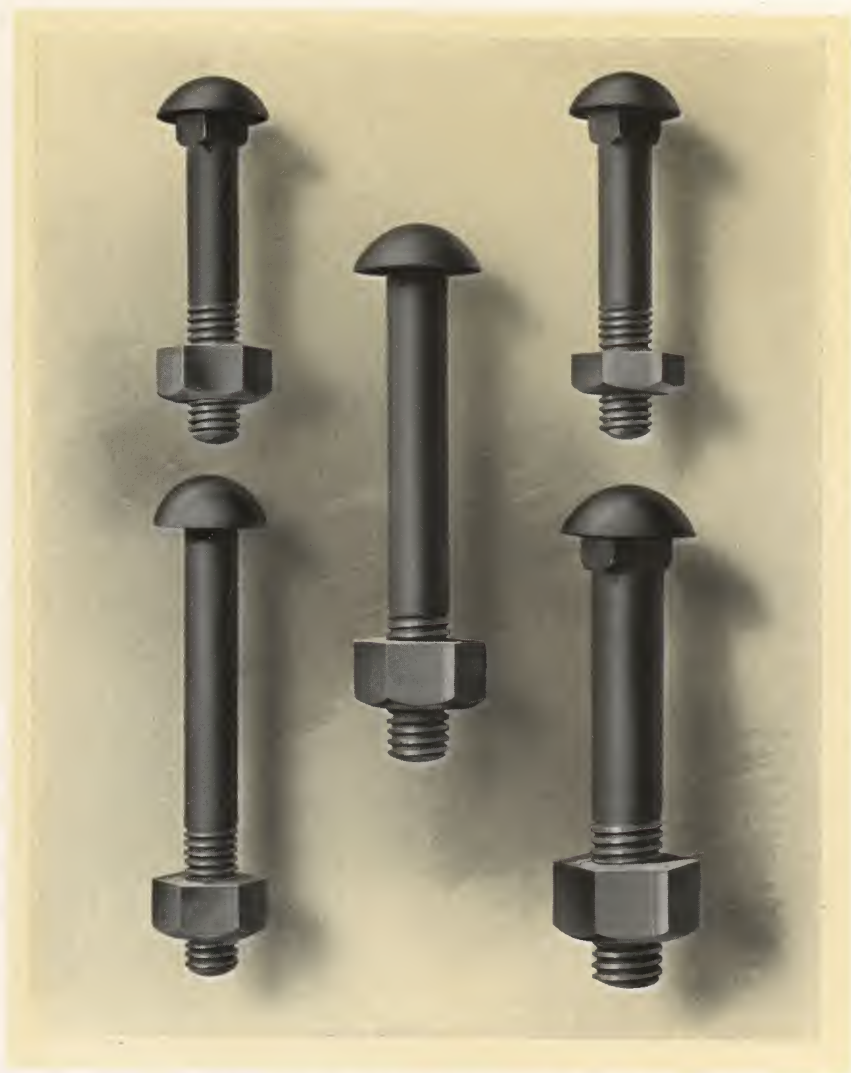


EMPIRE LOOM BOLTS

strayed to other fields. He made a steam-driven plow, and long before lawn mowers were manufactured he built one that was thoroughly practical. His creative brain conceived many kinds of machinery, and he put up the first reinforced concrete building ever erected.

While on the subject of inventions, let me digress long enough from these historical sketches to tell you about a new Empire bolt

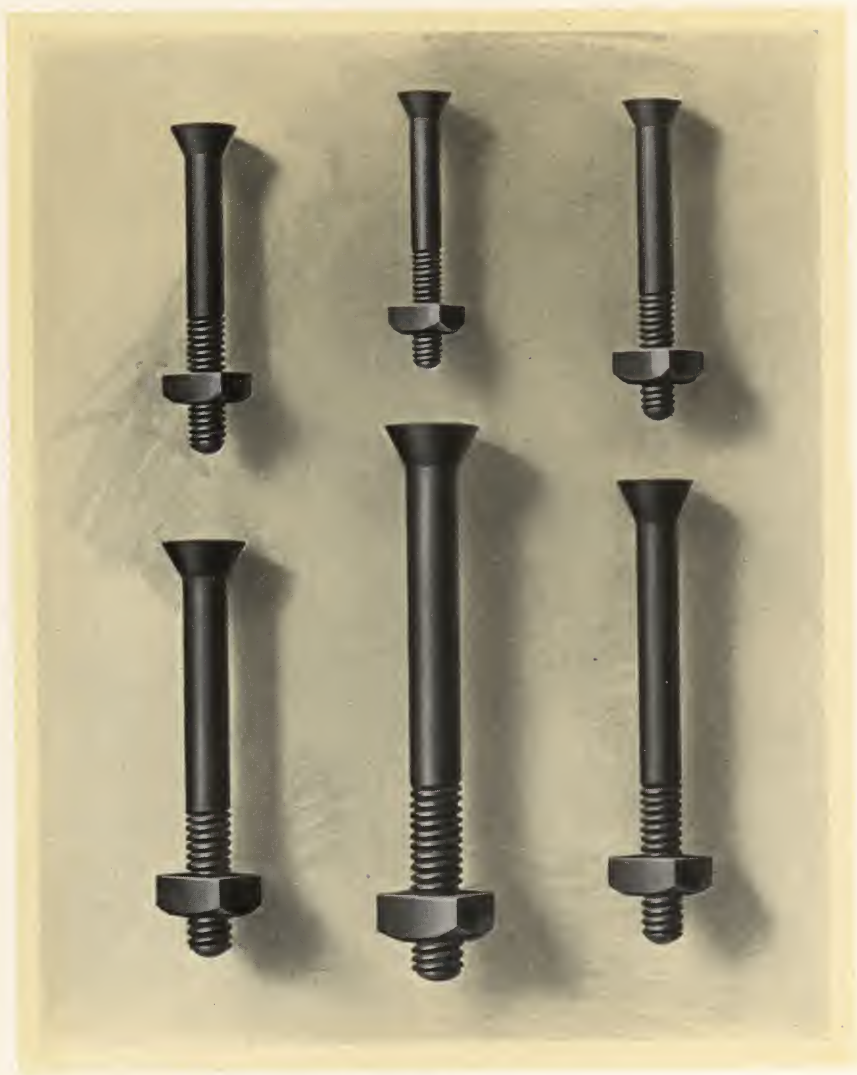




EMPIRE AUTOMOBILE WHEEL BOLTS

that has recently been placed upon the market. Its makers call it the *New Process Bolt*, because it is just that—a bolt produced in an entirely new way. Its thread, instead of being cut, is built-up on a specially prepared steel blank. Tools of uncanny precision, and machinery of a most ingenious kind (great batteries of them) are used in its production. What impressed me most of all was that, despite the speed with which they are

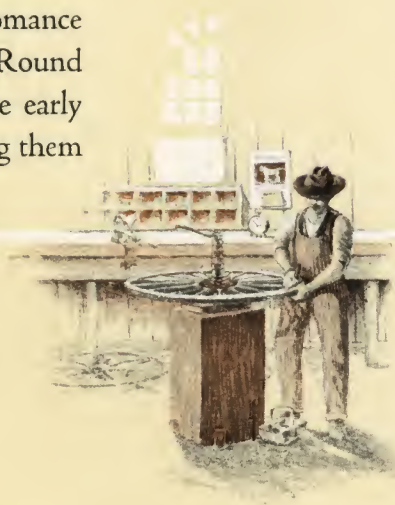


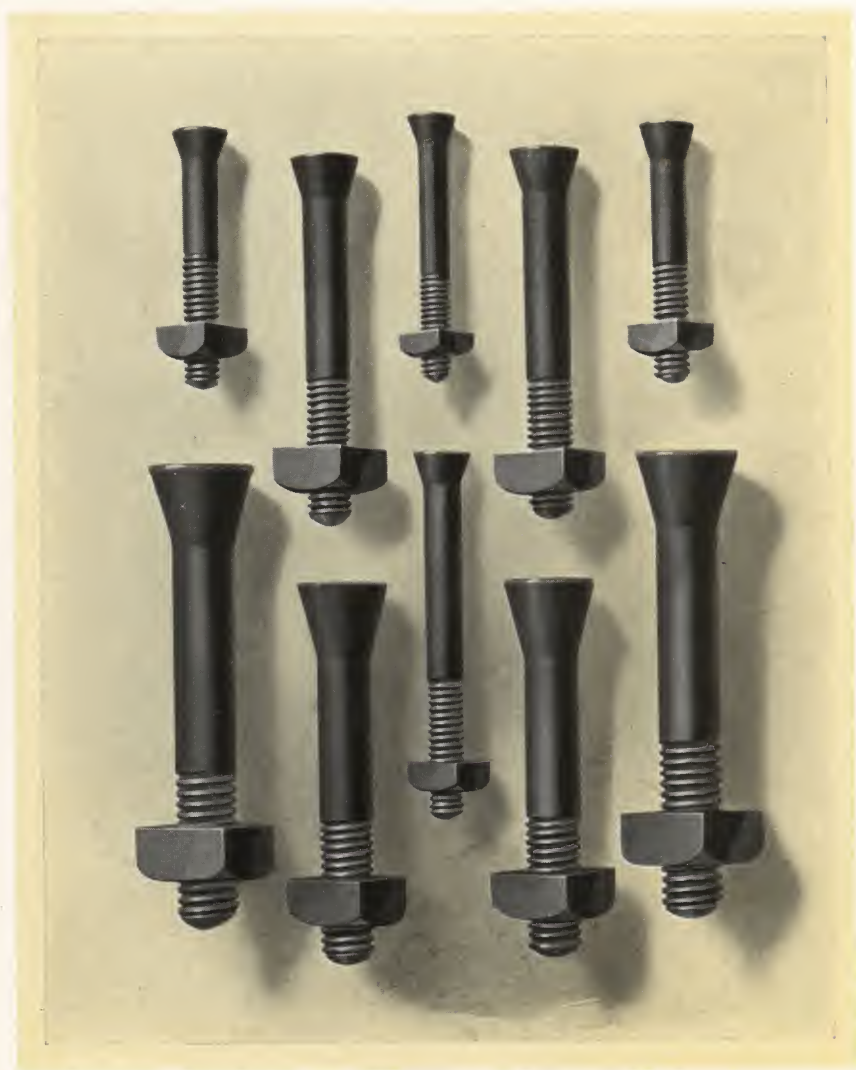


EMPIRE TIRE BOLTS

turned out, the New Process Bolts have a thread accuracy heretofore undreamed of in commercial bolts; in fact they are fairly comparable to the finest hardened and ground gauge both as to accuracy of lead and pitch diameter. This is clearly proven by the illustrations shown in another part of this book.

The spirit of old romance hangs over Pemberwick. Round about are houses where the early workman lived, and among them



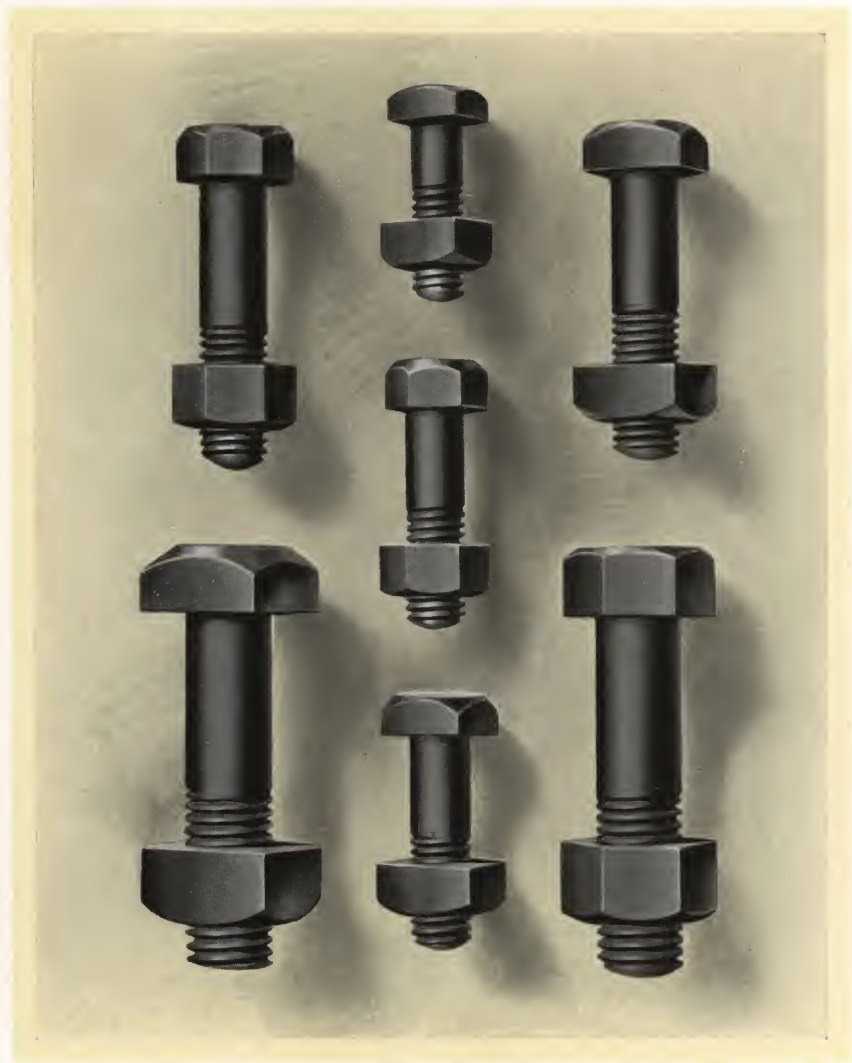


EMPIRE SLEIGH SHOE BOLTS

is the little old school house built by the old-time partners. And here at Pemberwick the founders of the Bolt Works strongly emphasized the human factor. Democracy with them was no theory; they believed workmen would reflect in their daily output just the treatment they received from men over them.

Thus was began at the start what is known to-day as an "organization." This was a shop





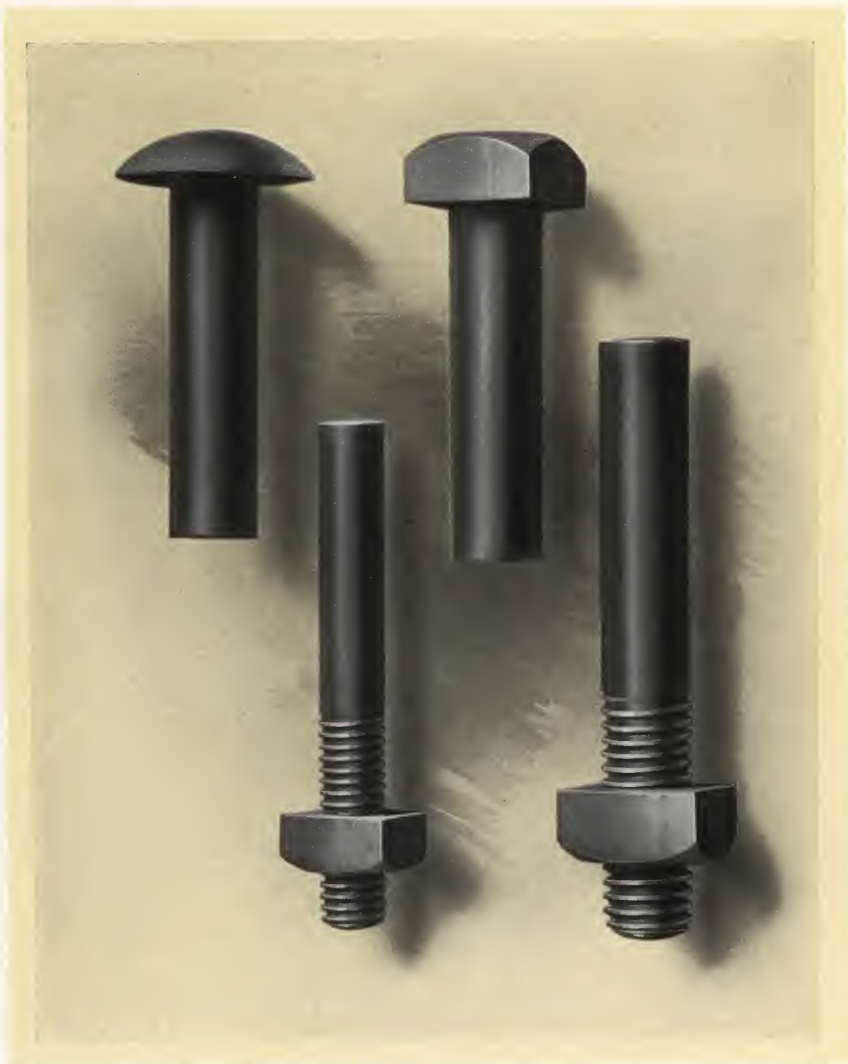
EMPIRE MACHINE BOLTS

family in reality. If one of the workmen desired to build a house, all of them dug the cellar and helped with the "raising." If one met with misfortune of any kind, there were always others who came to the rescue.

In the belfry of the old plant hung a large copper bell which every morning at five pealed blithely its message:

"Roll out, boys, and get ready for work!"



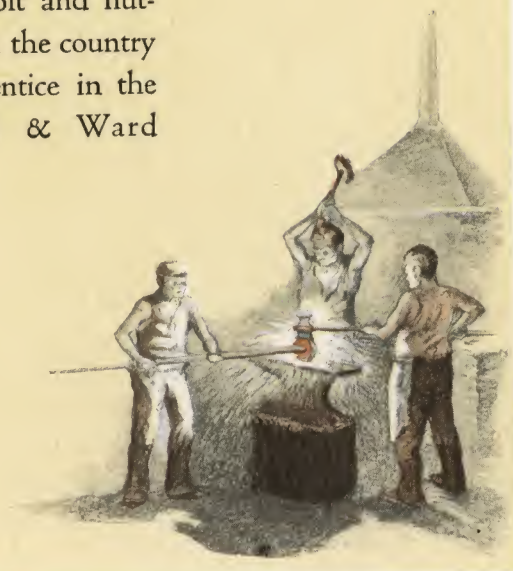


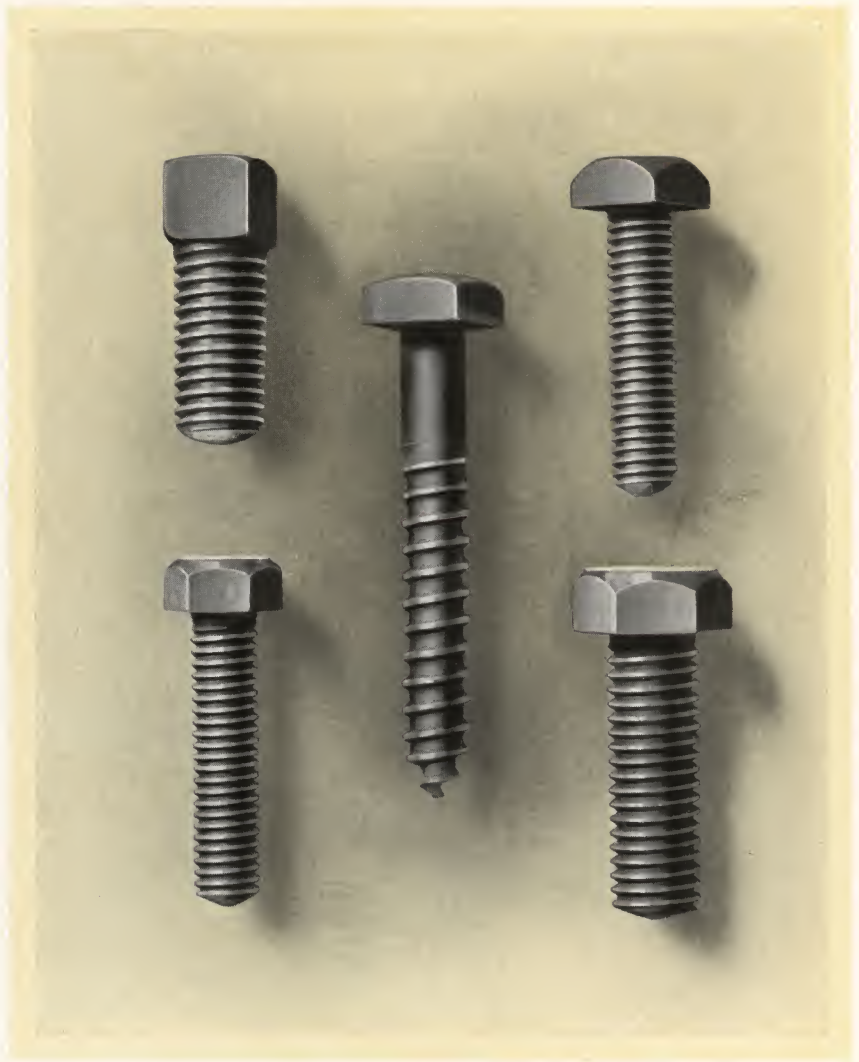
EMPIRE BLANK BOLTS AND BOLT ENDS

It rang again at nine in the evening:

"Go to bed, all ye good people, and rest yourselves for the making of *Quality* bolts and nuts on the morrow!"

In 1858 the plant employed nearly a hundred men. In that year Emil C. Boerner—afterwards the ablest bolt and nut-machine engineer in the country—became an apprentice in the Russell, Burdsall & Ward

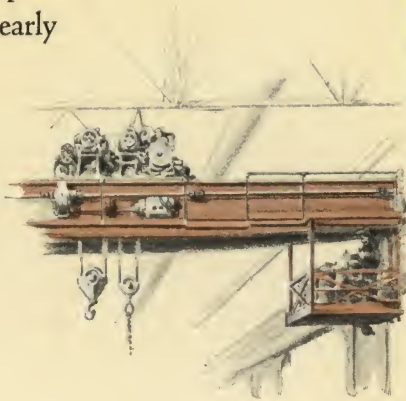




EMPIRE LAG SCREWS AND TAP BOLTS

machine shop. The record of the Company would not be complete without reference to his genius and the fifty-six years he spent in its service—developing many of the machines in present use. He was a man of lofty ideals and intense loyalty, and his methods inspired the whole organization. His death occurred in 1914.

Another picturesque important personality of those early





EMPIRE PLOW BOLTS

days, and afterward in Port Chester, was Mrs. Mary B. Alcott, who entered the employ of the firm in 1860, taking charge of inspection and the nutting and packing of bolts. She, too, stayed fifty-three years. The high reputation of the Company for *Quality* is due in large measure to the foundation she laid for good workmanship.

So conscientious and rigid was this little woman in her

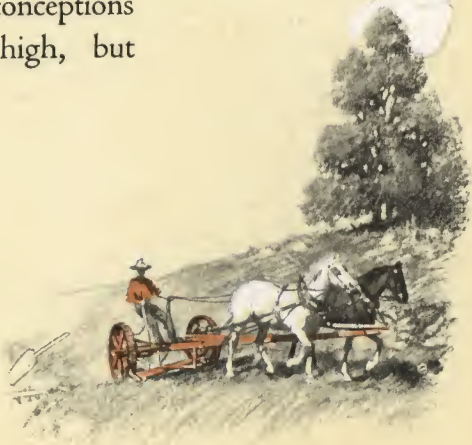


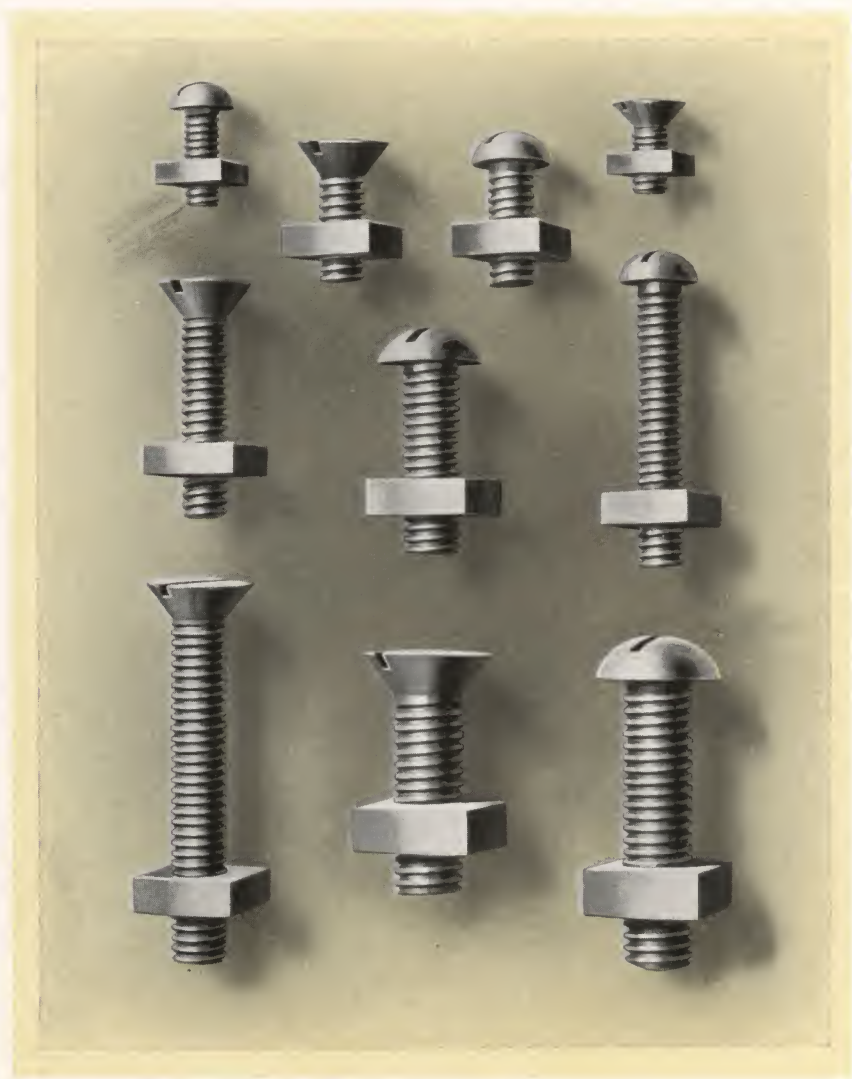


EMPIRE CULTIVATOR AND GUARD BOLTS

inspections, and so keen was her mechanical eye, that she inspired awe and fear in the foremen. Her dry wit withered any attempt to get by with mediocre goods.

Mrs. Alcott took orders from nobody, not even the proprietors, when it came to a judgment of *Quality*, which to her meant unvarying perfection. Sometimes it happened that her conceptions seemed impossibly high, but





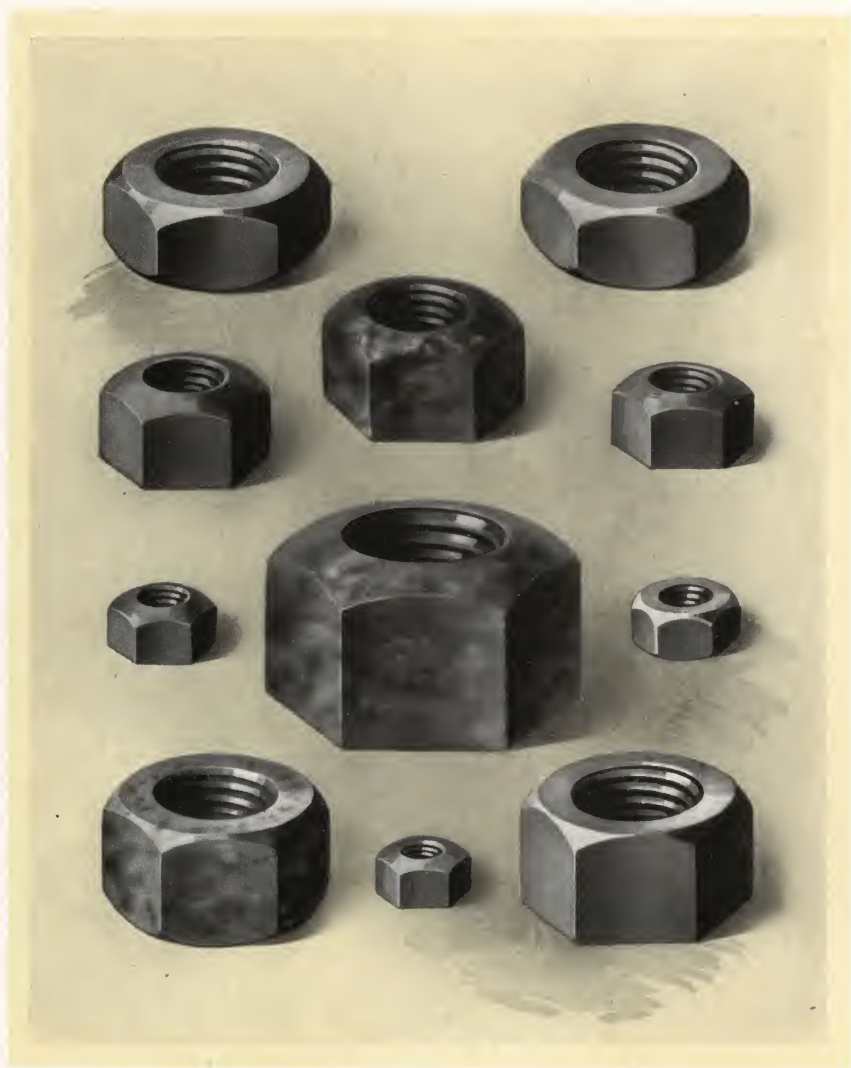
EMPIRE STOVE BOLTS

never for a moment would she relax—and the factory lived up to them; lives up to them yet. To-day the Company acknowledges a debt of perpetual gratitude.

Moreover, Mrs. Alcott's precepts and example played their part in the notable lack of labor trouble which marks the Bolt Works' history. She died in 1913.

The idea of sending men out over the country to sell the





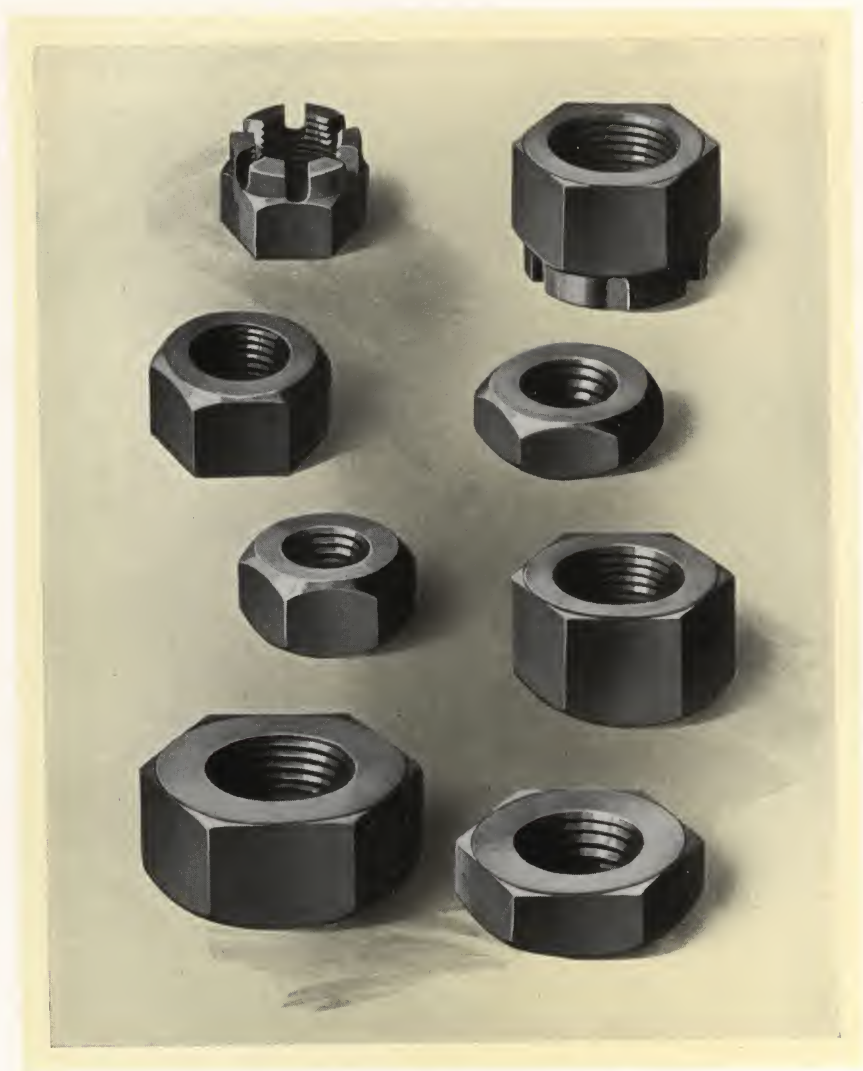
EMPIRE FINISHED AND CASE-HARDENED NUTS

Russell, Burdsall & Ward
Bolt and Nut Company

products of the Company was first conceived by Samuel Comly, whose connection with the organization goes back to 1863. In his prime, Mr. Comly's master salesmanship was predominant in the bolt and nut industry of America.

Before his ideas were accepted, the Company had been content to make the best bolts and nuts that men and machines could evolve, and then depend on their

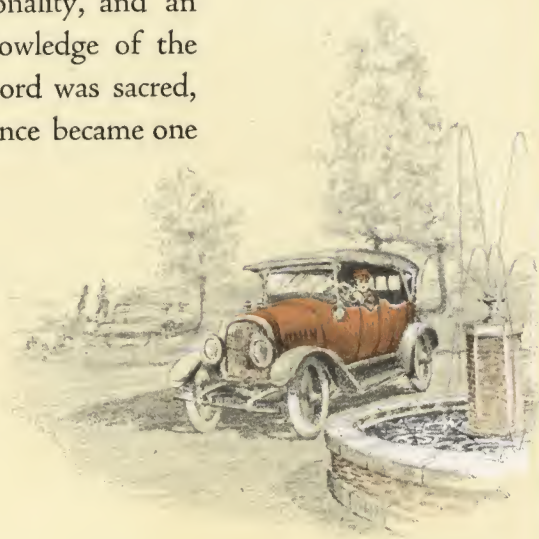




EMPIRE SEMI-FINISHED AND CASTLE NUTS

quality alone to market them. Mr. Comly, with a fine discernment and imagination, saw the truth that even a superlative product must be sold. His aggressive energies and big philosophy of selling were of untold value to the enterprise.

Here was a man possessed of remarkable personality, and an all-embracing knowledge of the business. His word was sacred, and so his influence became one





EMPIRE SEMI-FINISHED SLOTTED NUTS

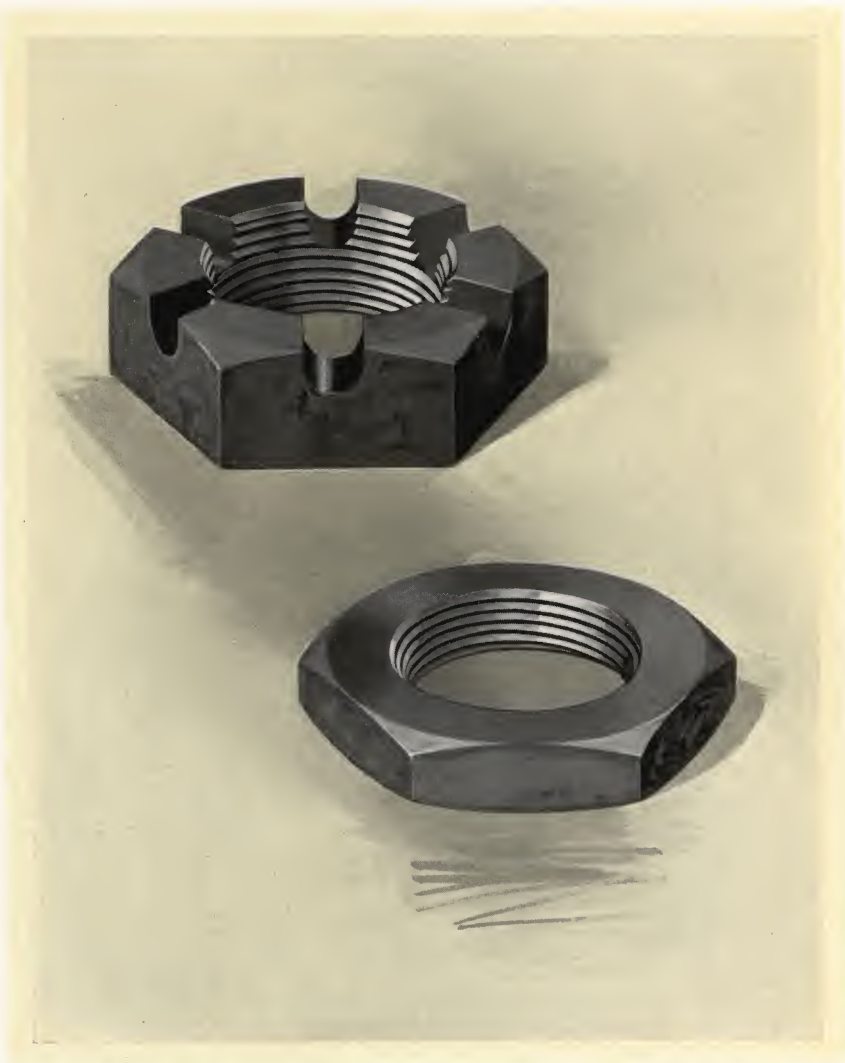
Russell, Burdsall & Ward Bolt and Nut Company

of the factors in the Company's conception of inviolate promises.

Mr. Comly's death occurred in 1923, after a half century of loyal endeavor devoted to the Russell, Burdsall & Ward undertakings. In every way his own personal code of honor has been stamped indelibly on the Company, and on its products and methods. He was vice-president at his death.

Another interesting personality of the Company was Mr. Joseph



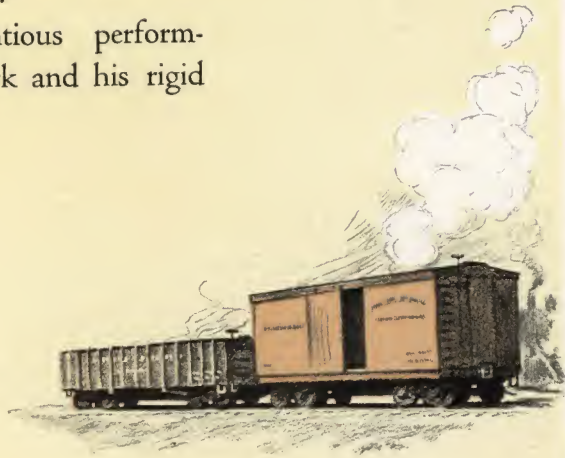


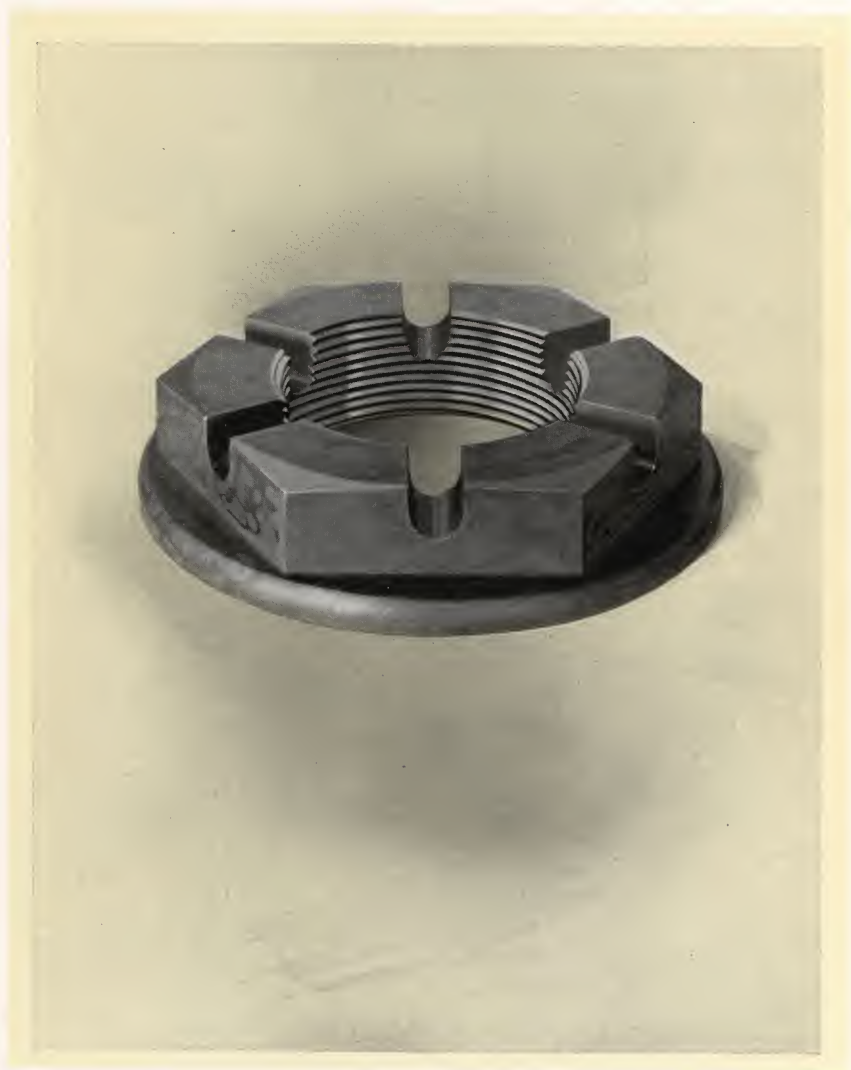
EMPIRE CRANK AND KNUCKLE PIN NUTS
Soft or Case-Hardened

H. Marshall, whose many years of faithful service dated from December, 1866.

Mr. Marshall started as pay clerk and from that time on always occupied positions of trust. His activities were not confined to the Company alone, however, as he took an active interest in the conduct of village and town affairs.

The conscientious performance of his work and his rigid



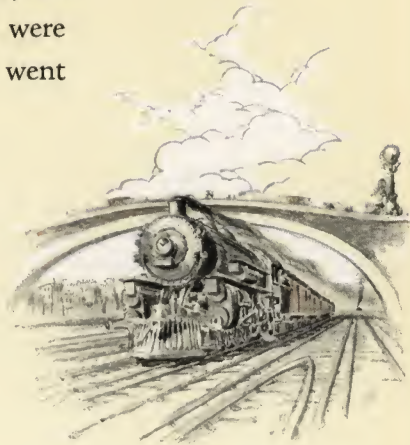


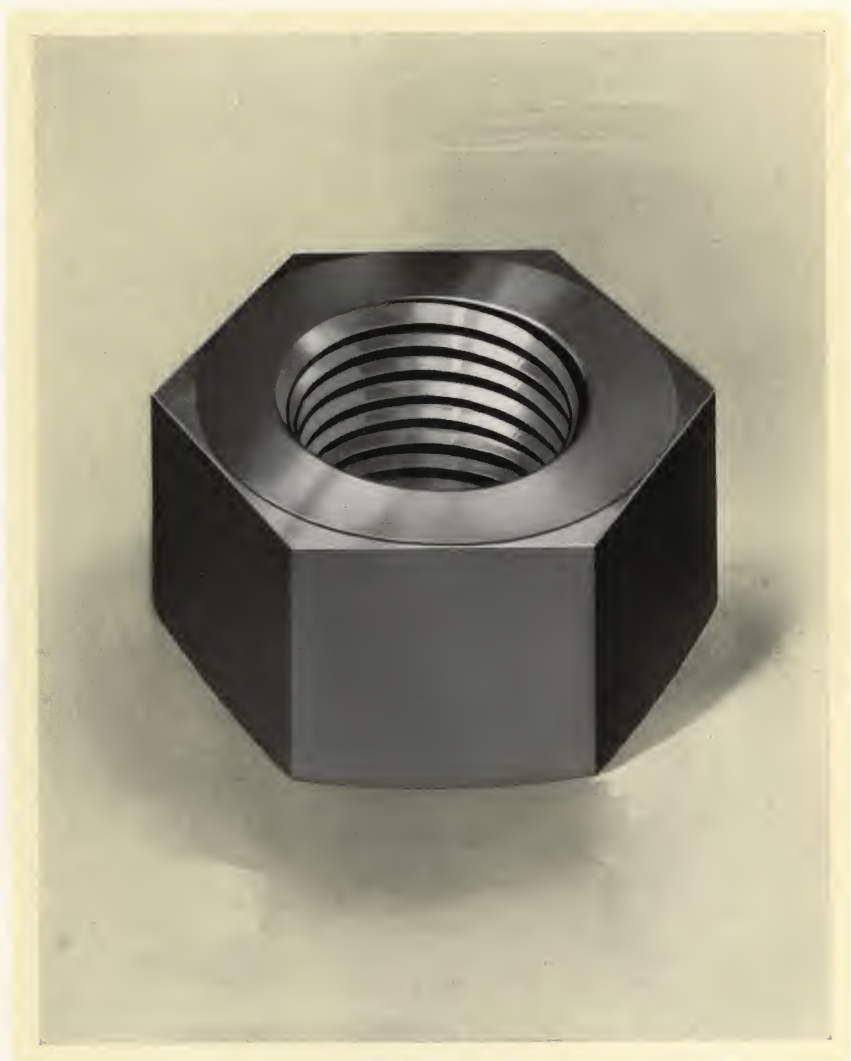
EMPIRE SPECIAL LOCOMOTIVE SLOTTED NUT
Soft or Case-Hardened

insistence for exactitude of details, tempered with a great kindness and a lovable nature, were an inspiration to those working with him and won him the respect and affection of all.

At the time of his death, in November, 1921, he was the third oldest active employee.

In the early sixties the firm adopted a Pension System, so that twenty-year employees were looked after. Injured men went



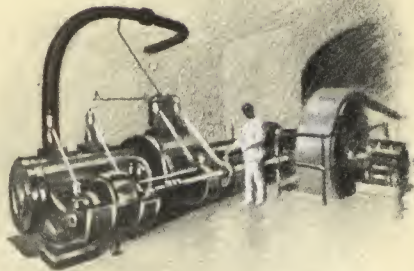


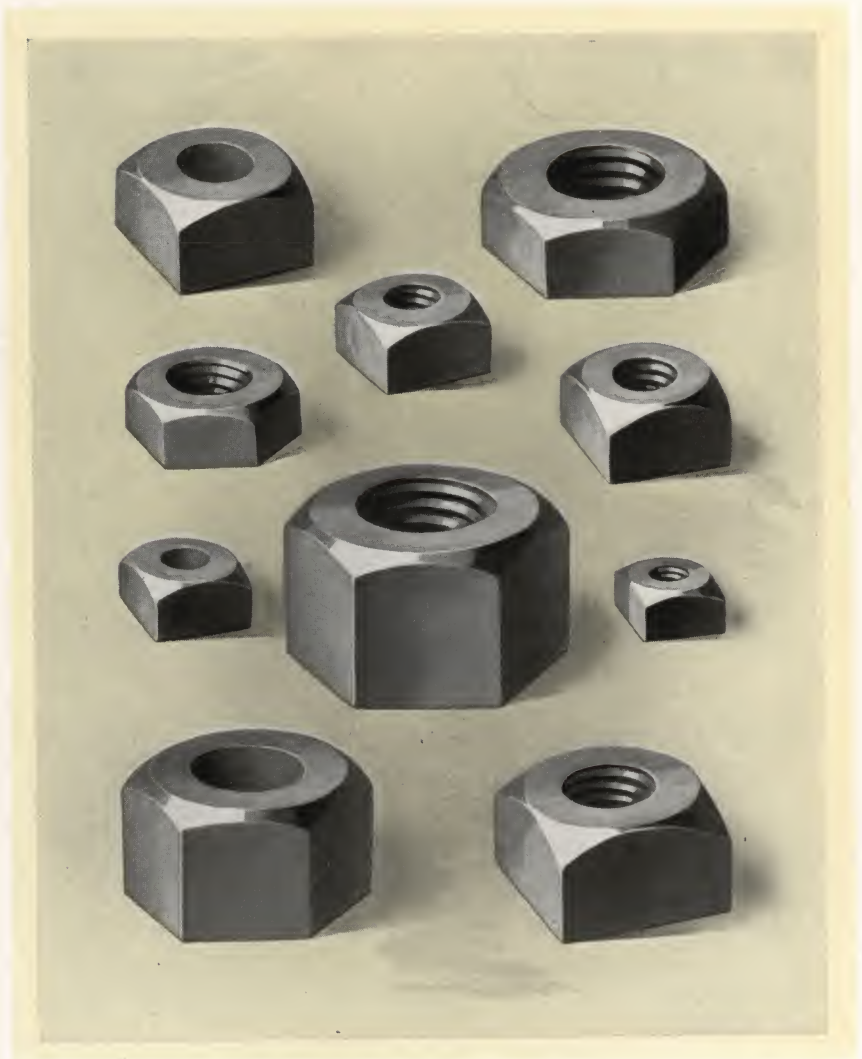
EMPIRE LARGE SEMI-FINISHED NUT

on half pay, and later this policy was amplified because the firm found it the Square Deal, which paid.

Since that long-ago time there has been no change in these policies. Along the Quality Road the Company has always traveled, and the early ideas of building an organization have followed on an expanding scale, the founders' simple principles.

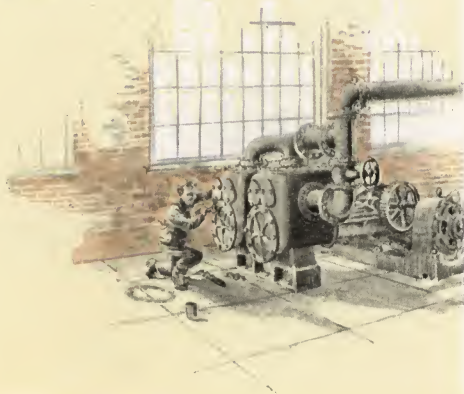
The Russell, Burdsall & Ward

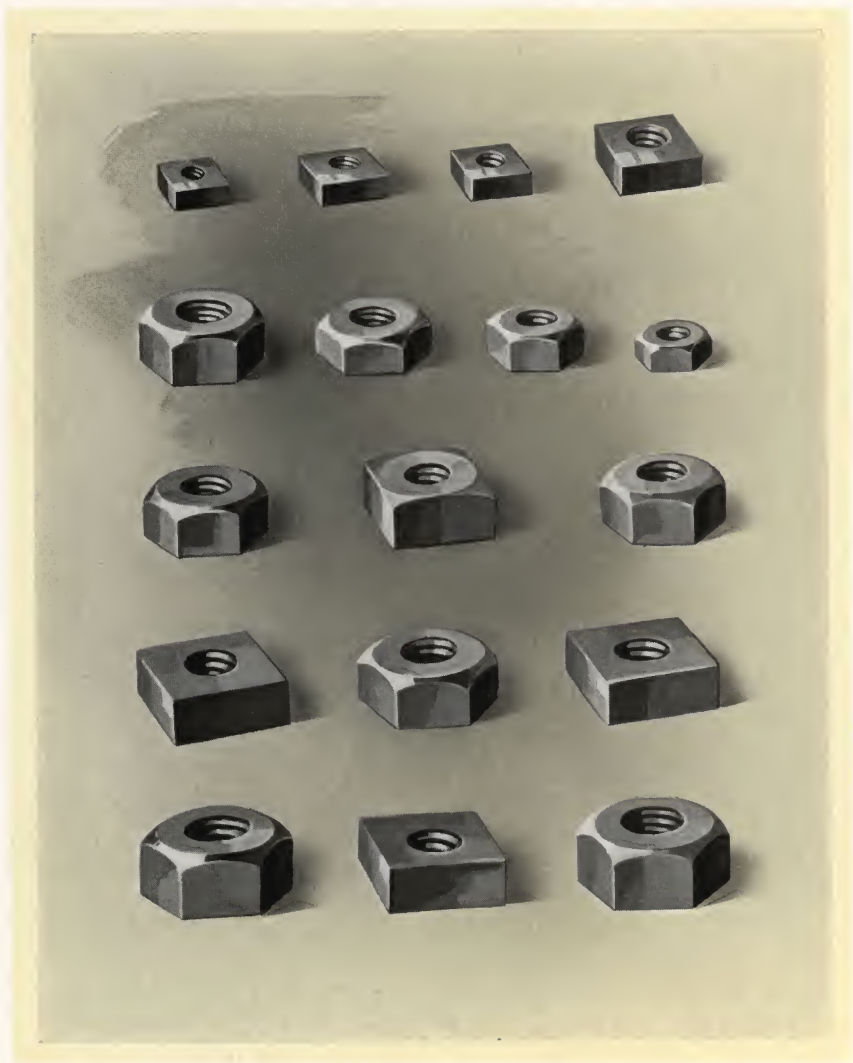




EMPIRE COLD PUNCHED, CHAMFERED AND TRIMMED NUTS

Company today, with all its vast growth and the multiplication of its forces many times, is indeed a lengthened shadow of the original Pemberwick concern—though personal contact between employers and workers is not so easy. Yet the Company thinks about the *other fellow* just as it did in the days of its founders, and the happy conditions existing all through the organization are reflected in the fact that the

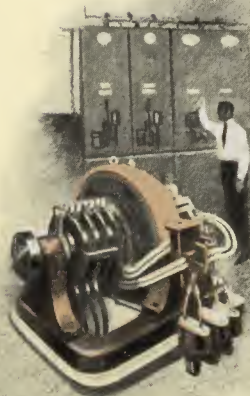




EMPIRE MACHINE SCREW NUTS

records show a higher degree of efficiency of output—even in these troublesome days—than at any other time in the Company's history.

Since 1845 the contentment of the Bolt Works has come from within. It all harks back to the psychology of human relations. The humanity factor—which is neither welfare nor charity, but Fair Play—must always start with the employer;



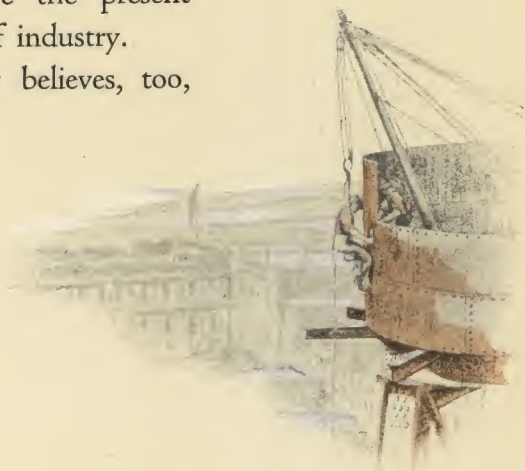


EMPIRE RIVETS

then inevitably the workmen voluntarily throw off their armor.

When the workmen feel that the boss considers them human beings and plays fair with them at every move in the great game of business and life, both production and quality become *team-work!* It is the belief of the heads of this business that team-work must solve the present labor problems of industry.

The Company believes, too,

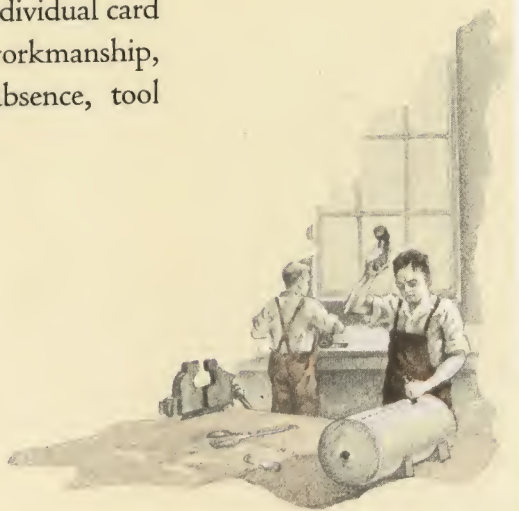


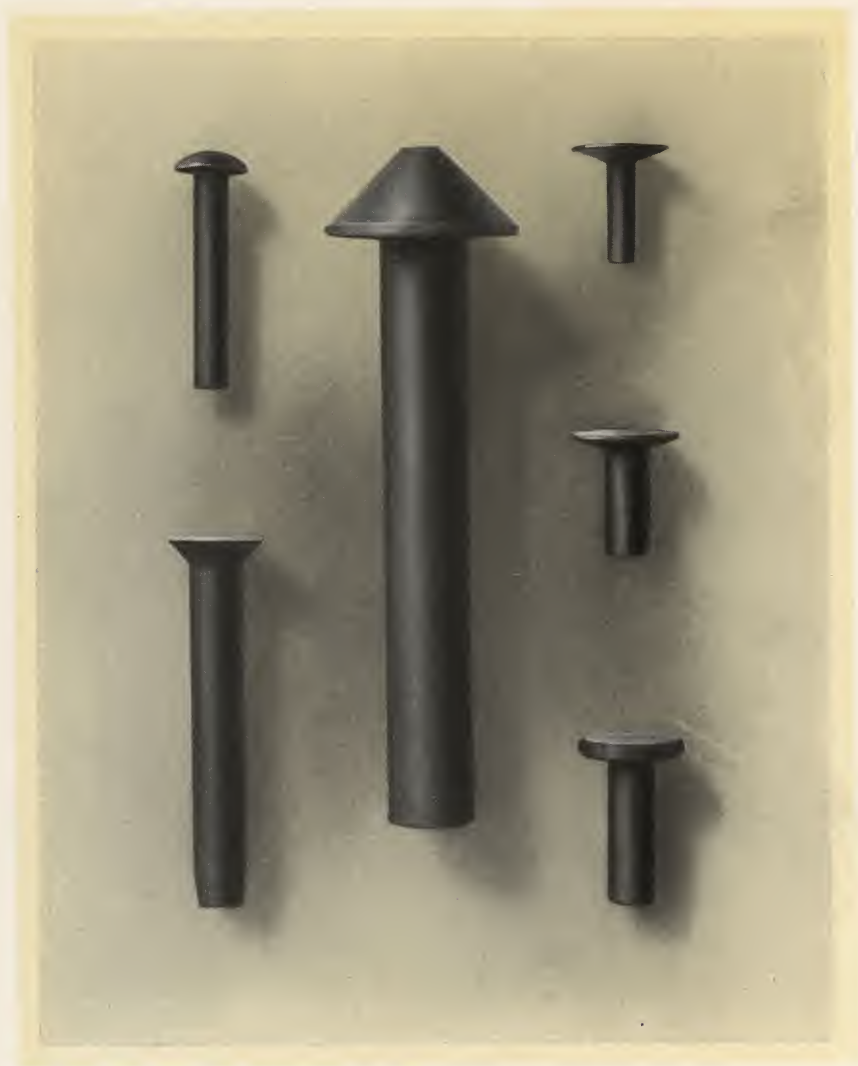


EMPIRE RIVETS

in recognizing brains and effort. In the office is kept an individual record of every workman. It doesn't matter whether he is Jim Jackson or Ladislaus Politauska; he may be a Methodist or Buddhist. The only thing that counts for or against him is his composite record at the plant.

The mechanic's individual card shows his *Quality* workmanship, production, time, absence, tool





EMPIRE SPECIAL PRODUCTS

and repair costs, and so on. From this card is compiled his rating, and if Ladislaus shows up a better man than Jim, he is advanced automatically.

The Company has never cut a piece rate, always aiming toward higher pay. The one unpardonable sin is bad workmanship.

All through the war such human influences were reflected at the Bolt Works in a high degree of loyalty. Among these





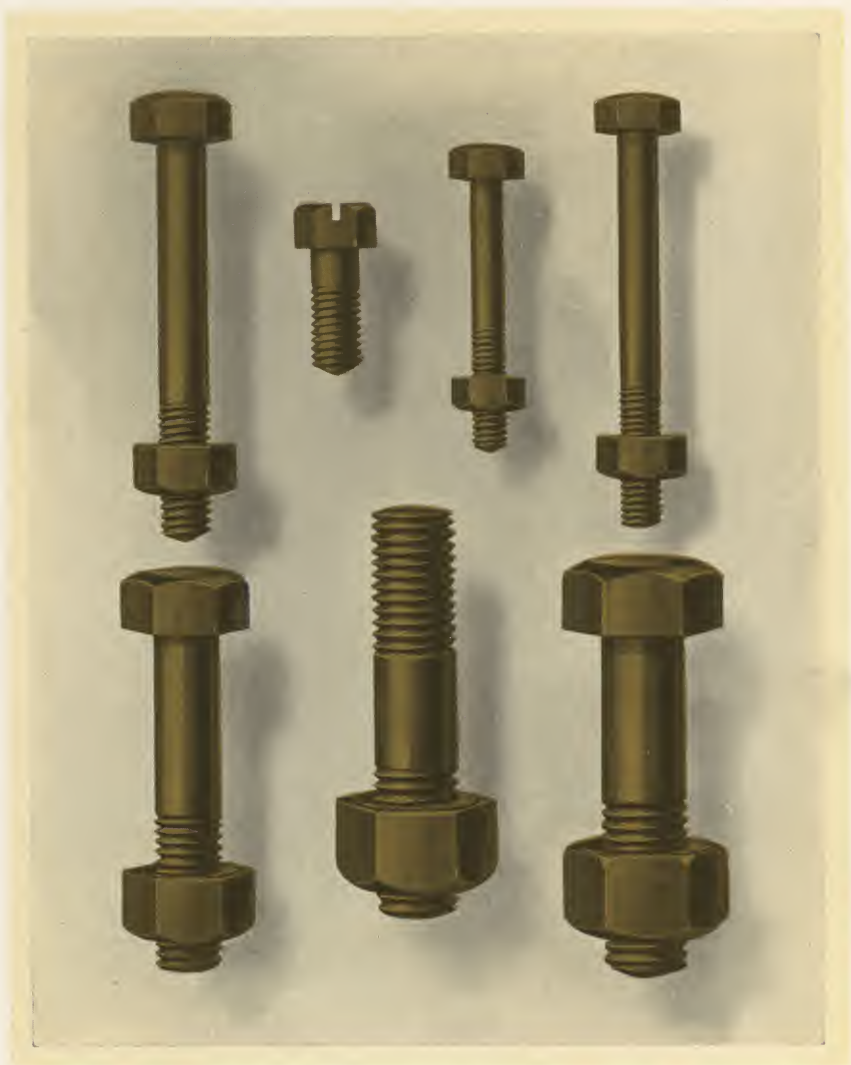
EMPIRE SPECIAL PRODUCTS

workmen, any chance enemy of America stood no show whatever.

But the Company, in its scheme of Fair Play, accords every man a trial before discharging him. Foremen do not have power to turn anyone out; yet are always consulted by the General Manager, who is in charge of employment.

The good employment manager is God-made, he can't be





EMPIRE BRASS BOLTS

built to order. To know every worker by name, and not to forget him, is an aim of this executive at Port Chester. Men who fail to make good in one department are tried out in other parts of the plant.

The Bolt Works is near many plants that were large munition makers during the war, and the labor shortage thereabouts was acute; but there was never a time when the Russell, Burdsall &



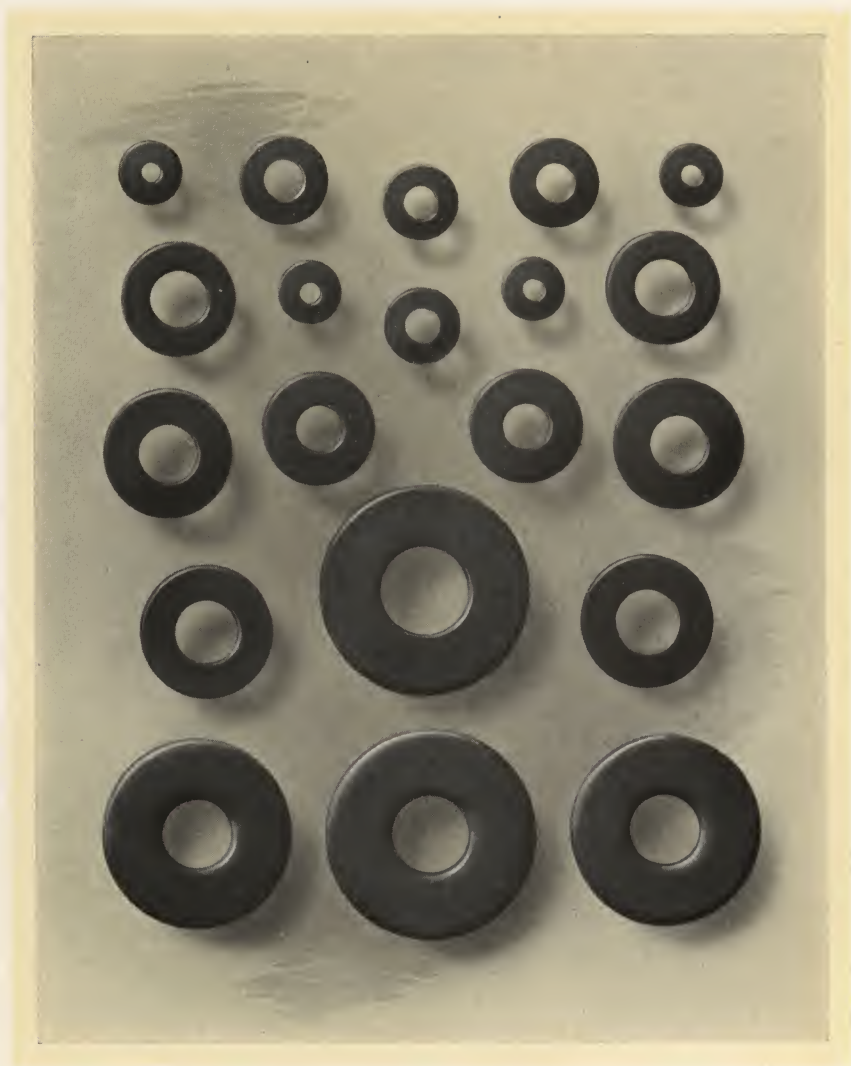


EMPIRE SPECIAL PRODUCTS

Ward Company did not have men at the gate seeking employment. Because its policy is the Square Deal, the factory went voluntarily to eight hours, with time-and-a-half for overtime, without a suggestion from the workmen.

It is the purpose of this narrative merely to indicate what lies back of the bolts and nuts themselves. To sum up briefly, the main thing back of them is *men*.

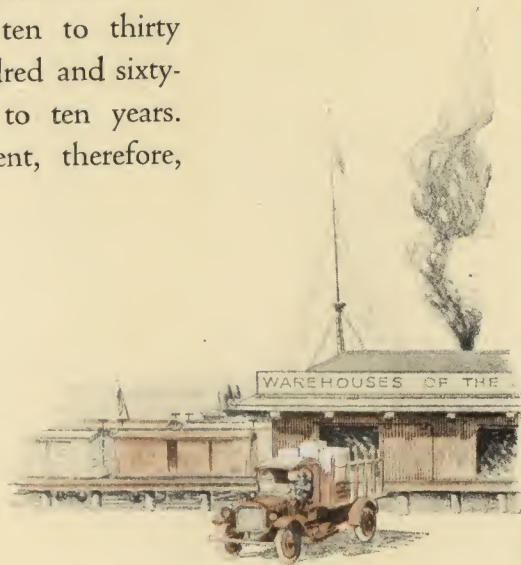




EMPIRE WASHERS

Russell, Burdsall & Ward Bolt and Nut Company

There are never causes without effects. The Russell, Burdsall & Ward Company has in its Port Chester and Pemberwick plants seventeen persons who have been on its payroll for over fifty years. It has eighty-two persons who have been there more than thirty years; two hundred and forty-eight from ten to thirty years; three hundred and sixty-seven from two to ten years. Over fifty per cent, therefore,





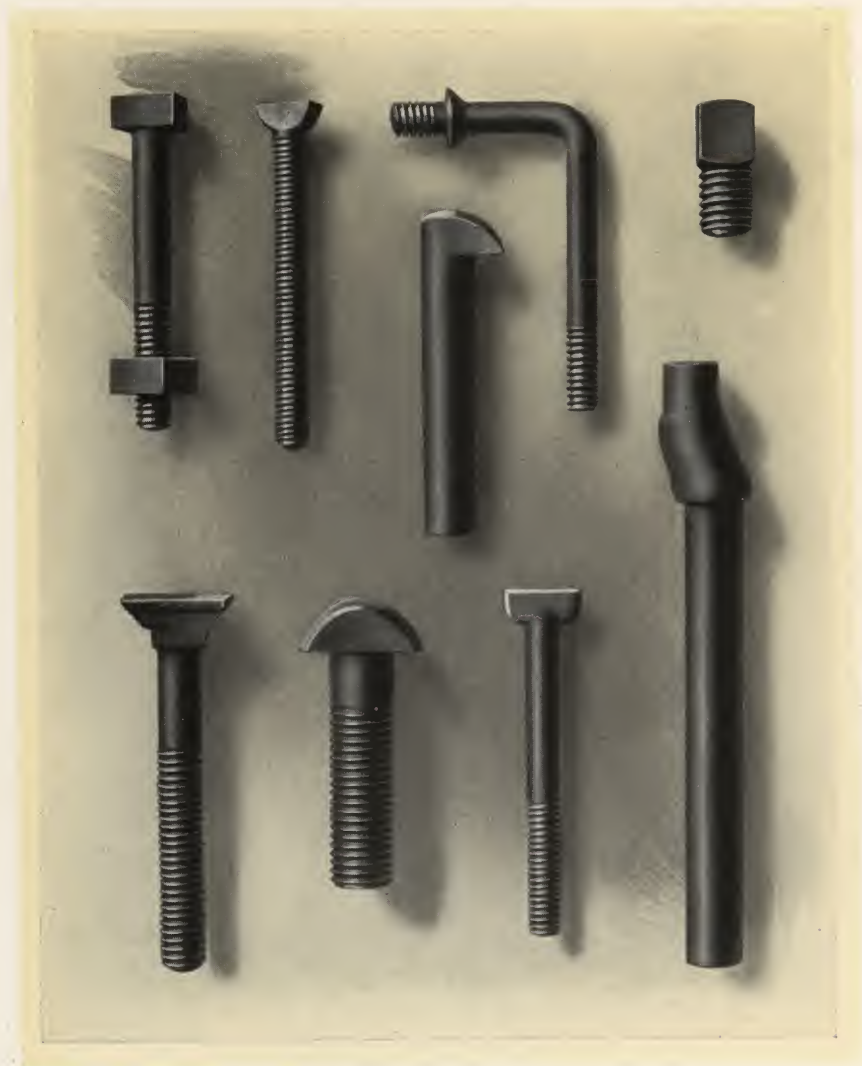
EMPIRE SPECIAL PRODUCTS

have seen at least two years of service.

These figures are eloquent—especially those that tell the story of the ten, thirty and fifty year men.

The influence of these long-service men on the whole factory force is beyond calculation. They are shining examples of ability and loyalty, which every day they help instil into the newer men. Thus the psychology

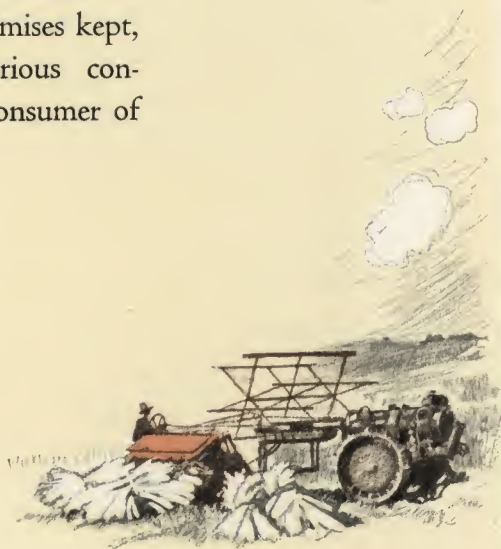




EMPIRE SPECIAL PRODUCTS

of the Square Deal automatically permeates the whole organization.

Buyers of bolts and nuts are interested first of all in *Service*—for even *Quality* goods are useless if undelivered. The Russell, Burdsall & Ward Company, with its long record of labor stability and promises kept, should have the serious consideration of every consumer of bolts and nuts.





EMPIRE SPECIAL PRODUCTS

THE EMPIRE
NEW PROCESS BOLT



EXHIBIT No. 1
HARDENED AND GROUND GAUGE

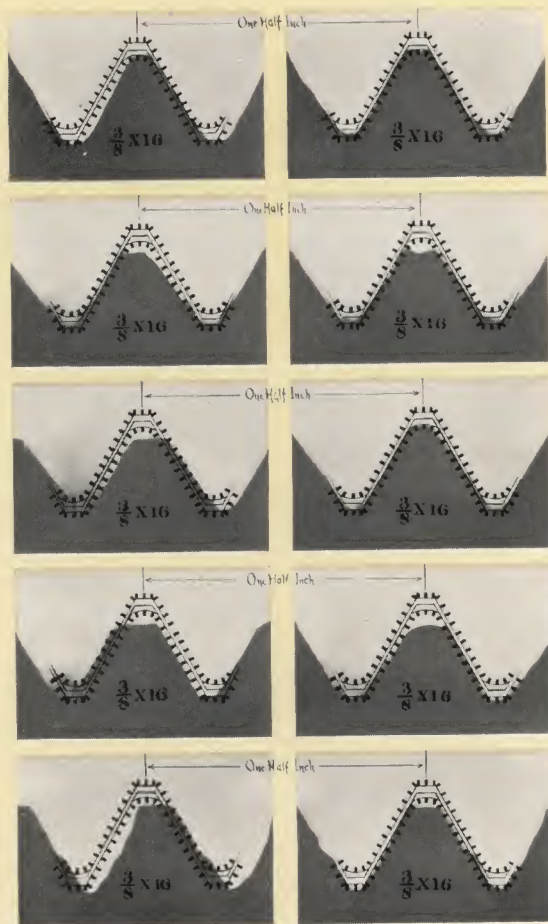


EXHIBIT No. 2
EMPIRE NEW PROCESS BOLT

EXHIBIT NO. 1, is a comparator photograph of a hardened and ground gauge. The dimensions of this check exactly right.

EXHIBIT NO. 2, is a photograph of the Empire New Process bolt thread. Note how closely this resembles the photograph of the gauge. By careful measurement, this bolt is .002 small in outside diameter; .0005 large in angle diameter; (this latter dimension controls the fit) .003 large in root diameter. (This is a good fault.) The lead is only .0001 short in $\frac{1}{2}$ ".

The five photographs shown, are of cut thread bolts as made by five of the leading manufacturers in this country. Note the rough and irregular threads



ILLUSTRATIONS OF REGULAR CUT THREAD BOLTS
AS PRODUCED BY FIVE OF THE LEADING BOLT AND NUT MANUFACTURERS

and how very apparent the errors are in these.

The outside diameter runs from .009 to .021 small. The angle diameter, which controls the fit, runs from .002 to .011 small, an error four to twenty times as great as in the Empire New Process bolts. Root diameter runs from .0002 to .003 large. Although this dimension is relatively unimportant, nevertheless, it indicates wide variations which do not appear in the Empire New Process bolt. The lead runs from .0015 long in $\frac{1}{2}$ " to .0045 short. This error is fifteen to forty-five times as great as the Empire New Process bolt.

THE
MATTHEWS-NORTHRUP
WORKS
BUFFALO CLEVELAND AND NEW YORK



